



THE COMPLETE FIELD GUIDE TO **STICK AND LEAF** INSECTS OF AUSTRALIA

Paul D Brock and Jack W Hasenpusch



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Foreword

Australia has an insect fauna that is as distinctive as its better-known mammalian fauna. Some of our stick insects are among the largest of all insects and, with others that resemble leaves and twigs, the group is truly diverse. And because of the research efforts of both Australian and non-Australian entomologists, they are becoming much better understood.

Unlike most other insect groups, stick insects (called ‘walking sticks’ in North America) are popular pets. Some of the most widely kept species happen to be Australian – at least five species are in this category. The reasons for keeping stick insects as pets are obscure to many people but easily explained: they often are large, do not require a great deal of room, and feed on a wide range of easily obtained plants. And they have interesting habits. They reproduce easily and do not require a great deal of time or emotion!

These insects are so popular that a club has been formed to cater to the fancy. The Phasmid Study Group is an international society, mostly of amateurs, that have a single common bond – they are interested in observing and breeding stick insects. Through the publication of their newsletter and journal, members have become familiar with the habits of dozens and dozens of species. In fact, they have added more to our knowledge of the biology of these insects than have the research scientists who are usually restricted to the study of dead material.

So it is with great interest that this field guide is offered to an enthusiastic audience of both Australians and non-Australians.



It provides the user with an easy way to identify most of the Australian species both from photographs and keys. Many of the photographs here are illustrating some species for the first time. The book also stresses the use of the structure, colour and size of the eggs as an identification tool. Of course, eggs can only be obtained from living sticks. Although not a recent observation, the maintaining of live specimens and the study of their eggs has resulted in the positive identification of many species the dead-bug taxonomists have confused. The information here on host plant preferences and cultural peculiarities of the species is bound to appeal to those wishing to keep the insects alive for observation.

I hope that this book will inspire more observations and lead to a greater awareness of these insects and their continued survival in the Australian habitat.

David Rentz



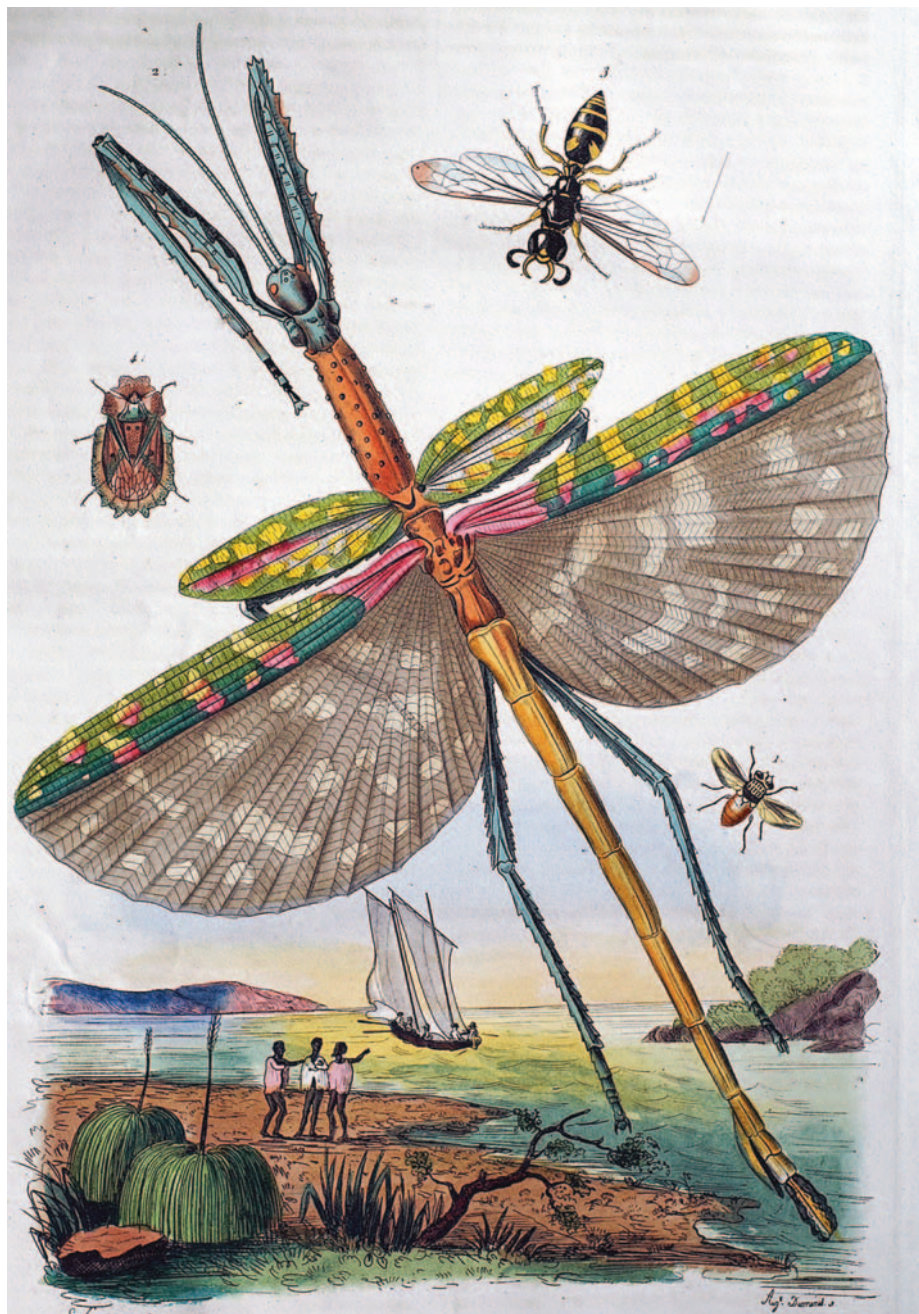
A female Wülfing's Stick-insect, *Acrophylla wuelfingi*, with wings outstretched.

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Young nymph of the Quick Stick-insect, *Acrophylla thoon*.



There are several beautiful paintings of Australian phasmids, this one illustrates a female Titan Stick-insect, *Acrophylla titan* (from Guérin, 1835).

Preface

Stick and leaf insects – together commonly known as phasmids – are well-camouflaged, nocturnal insects. Little is known about most of the 100 or so species found in Australia. We know more about three ‘pest’ species, mainly from the highlands of New South Wales, which have been regularly reported on since 1880. It is unfortunate that even basic information about most phasmid species, such as which plants they eat, is rarely recorded. Many species have not been studied for years and some, mainly from the rich rainforest regions of north-east Queensland, are still undescribed.

Occasionally stick insects make the Australian national or local press, usually with pictures of showy species found by residents. In 2001 there was much excitement amongst entomologists and the public when the Lord Howe Stick Insect, thought to have been extinct since 1918, was rediscovered on Ball’s Pyramid, a tiny volcanic rock jutting out of the sea, 23 km south-east of Lord Howe Island.

The lack of knowledge of Australian phasmids inspired us to write this field guide. We hope to encourage all those interested in these fascinating creatures to identify them, learn more about them, and help to conserve them. As with all wonders of the natural world, there is even an opportunity to discover species new to science – one never knows what will be encountered on excursions, even in places regularly visited. The authors have indeed been privileged to name some amazing new species.

Estimates of the true number of Australian phasmids have ranged from 150

to 200 species. There are several catalogues on Australian phasmids, the most recent being the authors’ *Studies on the Australian stick insects (Phasmida), including a checklist of species and bibliography* (2007), which lists 104 species and 1 subspecies. Many of what were originally considered to be separate species have now been ‘downgraded’ to synonyms, i.e. repeated descriptions. So far, there are 54 reported synonyms of Australian species, in many cases indicating the difficulty researchers have experienced with variation in species. Some species still await description, including a number of smaller or plain species, neglected by researchers, particularly in the genera *Candovia*, *Denhama*, *Hyracus* and *Pachymorpha*. In several cases, these are only known from single specimens, which it is not yet appropriate to describe. When all these genera have been thoroughly revised, there are an estimated 150 species. All described species are discussed in this book.

A taxonomic paper by Hennemann and Conle was published in late 2008 as this book was going to press. *Extatosoma tiaratum* (pages 126–128) is now in the Phasmatidae, new subfamily Extatosomatinae (from Tropicoderinae). *Ramulus stilpnoides* (page 119) is now in the Phasmatidae, subfamily Clitumninae.

The layout of this book is designed to be user-friendly and avoid very technical terms. There are practical, well-illustrated sections for even the most experienced phasmid hunter on anatomy, classification, collecting, photographing, rearing and studying these

insects, as well as concise illustrated notes on each species. In an attempt to simplify identification for novice enthusiasts, the section on pages 33–38 illustrates species in selected genera and includes a quick guide to the relevant sections of text. Most species are large and conspicuous enough to identify without additional magnification, but a 10 × to 20 × hand lens may be useful, particularly for eggs.

Widespread collecting, field trips, studies of collections worldwide, and links with other entomologists have enabled us to obtain sufficient material for this book. A number of taxonomists (specialists who

study classification) have misinterpreted differences in size, colour and body form, describing them as different species. Sometimes, wide variation can be seen in phasmids of the same population. Wherever possible, eggs are figured and specimens reared in order to improve our knowledge of these insects. Notes are given on habitat and behaviour, when available.

As in the *Zoological Catalogue of Australia*, the country is defined as including various islands with Australian political responsibility. Phasmids from Lord Howe Island, Balls Pyramid and Christmas Island are therefore included in this book.



A female Cigar Stick-insect, *Cigarrophasma tessellatum*, displaying the inner green margin of her outstretched wings. In the background is the gravestone of Frederick P Dodd, 'The Butterfly Man of Kuranda'.

Acknowledgements

We wish to thank a number of contacts for their assistance and/or observations during our many years of study on Australian phasmids. David Rentz, a world-renowned specialist on orthopteroid insects and author of marvellous books such as *Grasshopper Country: The Abundant Orthopteroid Insects of Australia* encouraged our studies and collected valuable specimens for study, as well as providing some excellent photographs.

Other photographers represented are Robert Brandle, Peter Chew, Brian Cox, Jason Hainke, Alan Henderson Minibeast Wildlife, Kathy Hill & David Marshall, David Knowles, Peter J. Lang, Tara Maginnis, Queensland Museum, Michael Ramsden, Jiva Sztraka, Michael Trennery, Sergi Romeu Vallés, Gary Wilson and Steve Wilson. In several cases with species described in 2007, photographs first appeared in *Zootaxa* 1570 (2007) and are reproduced here, with permission.

Curators of numerous museums kindly allowed access to the collections. In particular, thanks are extended to George Beccaloni and Judith Marshall of the Natural History Museum, London, and also to Ulrike Aspöck and the late Alfred Kaltenbach of the Naturhistorisches Museum, Vienna, where the first author undertook most of his detailed taxonomic studies. The research in Vienna was facilitated by a Synthesys grant in 2005.

It has been valuable checking the distribution of phasmids and checking rarer species in Australian museums, also

examining specimens at other institutions, with thanks to: Jan Forrest (South Australian Museum, Adelaide), Chris Burwell and Geoff Monteith (Queensland Museum, South Brisbane), Jacquie Recsei (now Australian Museum, Sydney) and Tom Weir (Australian National Insect Collection, Canberra), Graham Brown (Museum and Art Gallery of the Northern Territory, Darwin), the late Ross Storey (Dept. of Primary Industries, Mareeba), Peter Lillywhite, Ken Walker (Museum Victoria, Melbourne), Terry Houston (Western Australian Museum, Perth), Jude Philp (Macleay Museum, Sydney), David Britton, Graham Milledge and Martyn Robinson (Australian Museum, Sydney), Lynette Queale (plant identifications by Tim Croft and Peter Lang) (Biological Survey, Department of Environment and Heritage, South Australia), John Clarkson (Environmental Protection Agency, Mareeba), Norman Dowsett and Patrick Honan (Melbourne Zoo), Alan Henderson and colleagues (Bugs Alive Exhibition, Museum Victoria, Melbourne), Nick Bishop and Warrick Angus (Taronga Zoo, Sydney).

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Thanks also to the general public who contacted us through various newspaper articles and television shows, whose assistance has been invaluable. The permit issuing authorities and National Parks and Wildlife Service allowed us to collect in prime locations in New South Wales, Northern Territory, Queensland and South Australia, including National Parks and State Forests. Nick Alexander (CSIRO Publishing) has been enthusiastic about the project and kindly saw the book through to publication, offering advice when needed.



A mating pair of Robinson's Stick-insect, *Candovia robinsoni*, feeding on a rose.

1

INTRODUCTION

At present, we recognise 101 species of stick insect and three species of leaf insect in Australia, but there are likely to be more species awaiting discovery. Worldwide, there are about 3000 species of phasmids, mainly from the tropics. These scrub-dwelling or tree-inhabiting, nocturnal insects have fascinated generations of people. Their ability to remain motionless, resembling sticks or leaves, as a primary mechanism of defence can make them difficult to find. At times, some species are plentiful and become much more conspicuous by resting on doors, windows and walls of houses, and on cars at popular nature reserves.

Stick insects are by far the longest insects in the world, several species measuring close to, or over, half a metre when their outstretched legs are included. Stick and leaf insects are easily recognised, being generally thin and stick-like, sometimes with leaf-like legs, but usually not. On the other hand, true leaf insects have a broad, leaf-like, almost flat body. Some stick insect species, including 70 of the Australian species, have wings, although these may be very small and quite useless for flight. Many species are completely wingless.

Phasmids belong to the insect order Phasmida (or Phasmatodea), generally



Stick insects are plant feeders – this Goliath Stick-insect, *Eurycnema goliath*, is feeding on a eucalyptus leaf.

accepted to be closely related to Orthoptera (grasshoppers, katydids, and crickets) and are allied to cockroaches (Blattodea) and praying mantids (Mantodea). Phasmids are sometimes confused with slender mantid species, but the latter have forelegs designed to catch and eat live prey, whereas phasmids eat vegetation.

The Australian stick and leaf insect fauna (although less than four per cent of the global richness) includes many of the most striking phasmid species found anywhere in the world. Some of them have only recently been described, such as *Parapodacanthus hasenpuschorum*, described in 2003, and the longest Australian insect, *Ctenomorpha gargantua*, described in 2006. In several cases, older literature records have assisted in locating species only known from specimens caught in the 1800s. It is fortunate these insects still survive, as widespread clearing of habitat in the past has changed the Australian landscape and adversely affected the numbers of insects in general. It is pleasing that farmers and other individuals and organisations, supported by government policies, are keen on habitat conservation.

Some species are females only, reproducing by parthenogenesis – usually their eggs hatch only into females. The ‘Amazing Facts’ section opposite gives an indication why rearers and collectors become fascinated by phasmids. They exhibit such a wide range of behaviour and are often one of the most popular exhibits in zoos.

Anyone who has searched for phasmids in the wild knows they can be elusive, best found at night. It is amazing to see huge insects stand out amongst the vegetation. Sometimes they are very common, but search the same localities in the daytime



One of the many forms of phasmid defensive behaviour – the startle display. This is a female Strong Stick-insect, *Anchiale briareus*.



This Robinson's Stick-insect, *Candovia robinsoni*, is not just blowing bubbles. The secretion from its mouth is a common form of defence in many phasmids.

AMAZING AUSTRALIAN PHASMID FACTS

- Females of the Gargantuan Stick-insect, *Ctenomorpha gargantua*, are reported to reach an overall length of 615 mm, including outstretched legs.
- During peaks in population, pest species are capable of defoliating forests.
- The Titan Stick-insect, *Acrophylla titan*, holds the record for number of eggs laid (over 2050) by any phasmid.
- Phasmid eggs are much sought after by ants. The eggs of many phasmid species have a knob which ants feed on after transporting them underground. The eggs are then protected from parasites and many predators.
- The Lord Howe Island Stick-insect, *Dryococelus australis*, is literally hanging onto life on the tiny volcanic island, Ball's Pyramid. Thought to be extinct, it was rediscovered in 2001.
- The true broad-bodied leaf insects are rare, but do exist, although hardly anything is known about them.
- Australian stick insects have made several film appearances; Macleay's Spectre, *Extatosoma tiaratum*, appears regularly on television programmes, including 'I'm a Celebrity Get Me Out of Here!' in the UK, where contestants have had to eat these insects, or put their hands into cages containing specimens.



A female Macleay's Spectre, *Extatosoma tiaratum*, star of horror films. Its mouthparts and antennal segments can be seen clearly.

and one would be very fortunate to find any at all as they are so well hidden.

The life cycle and behaviour of phasmids fascinates rearers of these insects. They are easy to keep in culture and are particularly popular with schoolchildren, as they are easy to handle.

Many phasmids have a range of defence behaviour, suddenly opening brightly coloured wings, kicking out with spiny hind legs, producing fluid from their mouthparts, spraying an irritating chemical, or simply playing dead.

External anatomy

Most phasmids are relatively large, conspicuous insects. Males are often smaller and slenderer than females. Because the variation between the sexes (known as sexual dimorphism) is sometimes extreme, it may be difficult to identify a male and female as belonging to the same species unless they are mating. With practice, identification will become more straightforward and identification of commoner species should be fairly easy, although variations in size, colour or body form may be expected from time to time, and can be confusing.

Wingless *Denhama* and *Hyrtacus* species as well as the smaller, winged species may be particularly difficult to identify, often requiring an experienced phasmid specialist to examine them. Details of the basic structure of phasmids are given below.

Head

The head of a phasmid is oval to rectangular in shape, sometimes armed with spines, horns or protuberances. The head is made up of numerous plates (or sclerites) fused together to form a solid capsule that carries the paired antennae, the eyes and the mouthparts.

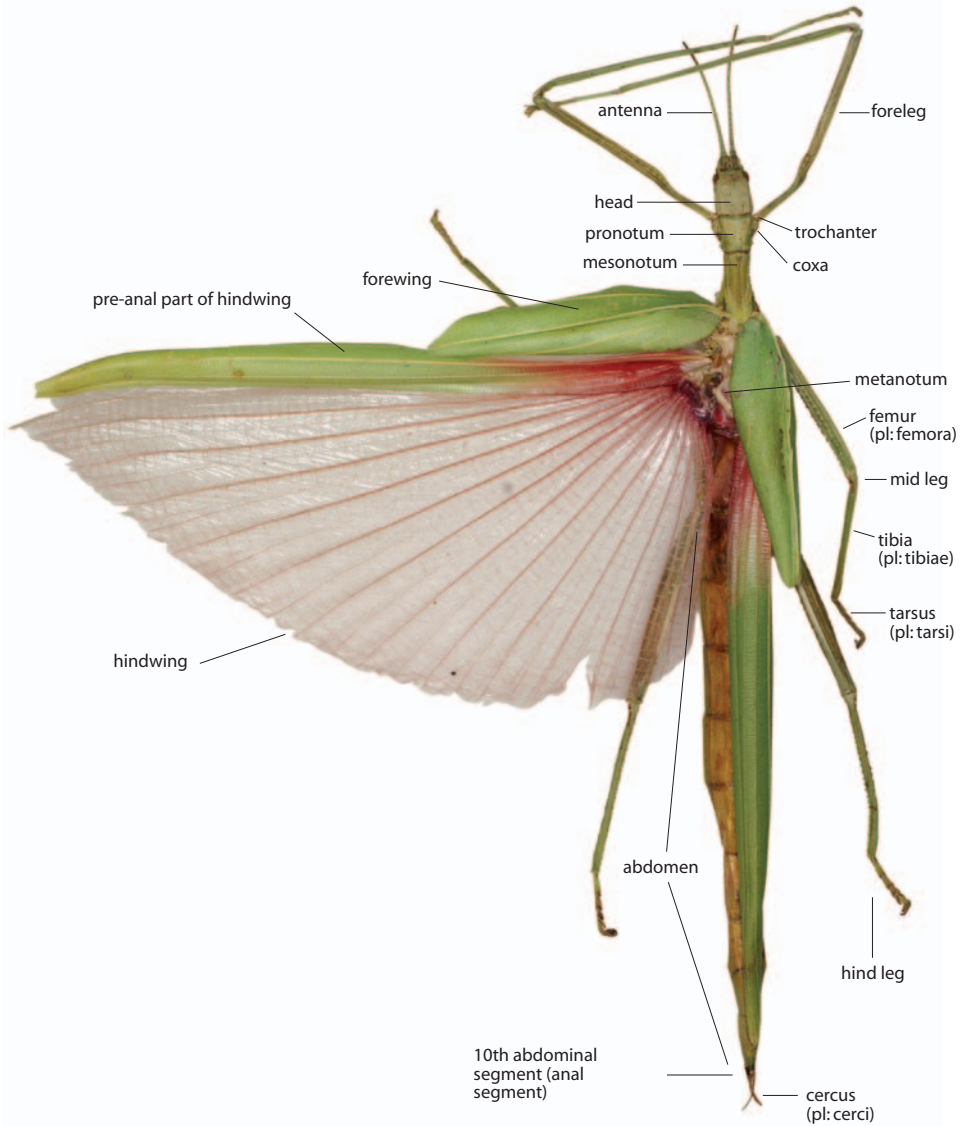
The slender antennae are sometimes short, but more often long, consisting of between eight and 80 (or more) segments. The antennae of the female are shorter than those of the male. They are covered by sensory hairs, important for helping the insect detect its surroundings. The length of the antennae provides a useful first stage in identifying the species, although nymphal antennae in many species are often shorter than those of the adult.

The pair of compound eyes varies in size, and many species have relatively small eyes. Made of many separate units, the compound eyes can perceive movement, unlike smaller ocelli (where present), which detect the presence of light. Three ocelli only are present in a minority of winged species, usually only males.

A stick insect spends much time eating and its mouthparts consist of the labrum (upper lips), a pair of mandibles (jaws) suitable for chewing leaves, and a pair of maxillae (secondary jaws), each of which bears a five-segmented sensory palp (the maxillary palp), and a labium (lower lip), which has a pair of three-segmented labial palps. The palps help the stick insect in touching and tasting its food plants.

Thorax

The elongate thorax consists of three segments, which bear both the wings and the legs: the shortest segment, the prothorax, carries the forelegs; the second, and usually longest segment, the mesothorax, carries the mid legs and forewings (if present), and the third segment, the metathorax, carries the hind legs and hind wings (if present). The metathorax is usually shorter than the mesothorax and may be fused with the first abdominal segment (the median segment). The upper surfaces of the three segments are



The key parts of a stick insect.

known as the pronotum, the mesonotum and the metanotum respectively.

The thorax is smooth in some species, or may include a variable number of granules, tubercles (small knoblike or rounded protuberances) and/or spines. The thorax is often very long and stick-like, but is particularly broadened in the true leaf insects.

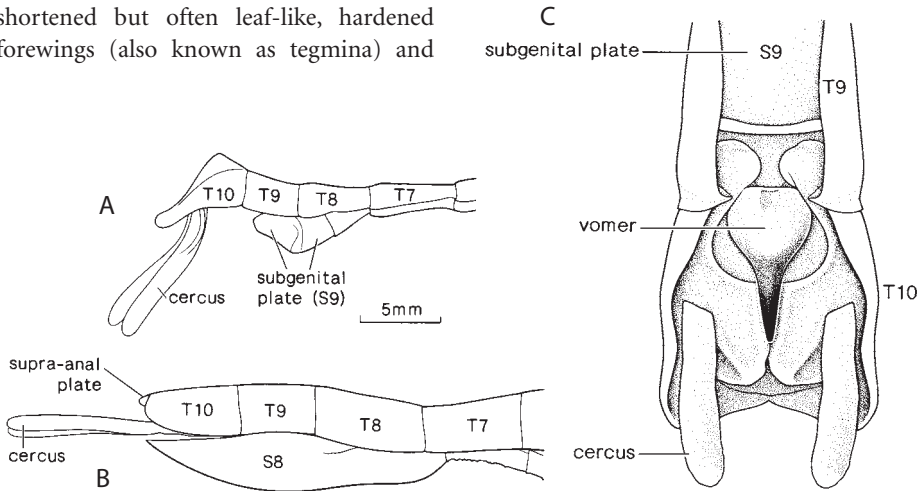
The legs are often long and slender and may be smooth, spiny or lobed, often with ridges and/or grooves along their length. The first segment is a small coxa, and the second segment (trochanter) is also much reduced. The long third segment, or femur, is sometimes stout. The base of each fore femur usually has an inner depression, to accommodate the head when the legs are extended forwards when at rest. The tibiae are slender, often longer than the femora, possibly with a short pair of spines at the tip, like the femora. Tarsi are five-segmented, with terminal claws and arolium, helping insects cling onto and walk along branches.

Wings, where present, consist of usually shortened but often leaf-like, hardened forewings (also known as tegmina) and

the much larger, broad hind wings (alae). In some species, hind wings are shorter than forewings. When folded, the pre-anal part of the hind wings is all that is visible, until these are opened. When disturbed, some species readily take flight, or flash open bright wings in a startle display. Many Australian species have very bright areas on their wings. Males of Australian species can usually fly well; sometimes the females can too. Wings are often reduced in the female.

Abdomen

The abdomen is often cylindrical or compressed, sometimes bearing granulations, tubercles, spines or lobes. There are ten segments on the upper (dorsal) surface, including the median segment, which may be fused with the metathorax. The final abdominal segment (anal segment) has a pair of terminal appendages each called a cercus. In *Ctenomorpha*, the cerci are huge and readily characterise the genus. In some other genera, they are hardly noticeable.



End of the abdomen. A: lateral view of male. B: lateral view of female. C: ventral (underside) view of male. (Source: The Insects of Australia, 1991)

The male abdominal segment is covered ventrally and laterally by the swollen subgenital plate (also known as the operculum or poculum), which covers the aedeagus (male copulatory organ). In some groups a solid, often hardened structure is present (vomer) on the underside of the 10th sternite. The male's claspers grasp the female genital organ during copulation.

The female has a boat-shaped structure called the operculum (or subgenital plate) which is useful for identification. The operculum covers three pairs of valves, sometimes forming an ovipositor for egg-laying in soil, such as in *Eurycantha calcarata*, or a chute, which helps distribute eggs of some of the largest Australian phasmids. A supra-anal plate is present in some females; usually a slight central extension at the end of the 10th abdominal (or anal) segment.

The abdomen houses the tracheal system, or breathing apparatus, which expands to take in and expel air through spiracles.

The food of a stick insect is broken down, digested and taken into the body so that it can be distributed by the transporting blood to the organs that require it. The digestive system involves a closed tube, the alimentary canal, which extends from the mouth through the body to the anal opening, where waste is expelled by faeces. These droppings (also known as frass) may sometimes be mistaken for eggs.

Eggs

The eggs of phasmids often look like seeds, and the shape and structure of the eggs of some Australian species is quite unusual. Each female lays a number of eggs during her lifetime – *Acrophylla titan* has been



An egg of the goliath Stick-insect, *Eurycnema goliath*, ready to be flicked to the ground.



A selection of phasmid eggs, which often resemble seeds.



The egg of *Eurycnema goliath*. Ants are partial to the capitulum, or 'knob' on top of the egg.



Ant damage to the eggs of the Peppermint Stick-insect, *Megacrania batesii*.

recorded depositing a huge total of around 2050 eggs while in captivity. However, around 400 to 500 eggs is a more reasonable average for many species.

Usually eggs are laid singly and are often dropped or flicked to the ground beneath the female. While some may fall prey to animals, the capitulum (knob) on the top of many eggs of many species of phasmids is attractive to ants, which carry the eggs away by this structure and bury them.

Surprisingly, this may improve their chances of survival, as the ants eat the capitulum, protecting the egg capsules from some predators. Not all ants protect the eggs; the outer capsules of at least two species, *Megacrania batesii* and *Cigarrophasma tessellatum*, are sometimes attacked by ants.

Denhama and *Hyrtacus* species prefer to glue eggs to leaves, branches or in crevices, while other phasmid species even bury them in soil. *Eurycantha calcarata*,

for example, uses her powerful, beak-like ovipositor to deposit her 7-mm-long eggs in the soil, the largest eggs of any Australian phasmid. Other species with large eggs include *Eurycnema osiris* (up to 6.5 mm), *Dryococelus australis* (6 mm) and *Eurycnema goliath* (6 mm). The female *Denhama gracilis*, only about 75–90 mm in length, lays eggs that are about 6.5 mm in length. The eggs of some of the longer *Denhama* species are therefore likely to be even longer than those of *Eurycnema calcarata*. The incubation period for phasmid eggs varies from species to species, some hatching in as little as a month, others taking over a year to hatch.

Nymphs

Newly-hatched phasmids, known as first-instar nymphs, often resemble miniature versions of adults. Sometimes a nymph becomes caught in its egg shell during hatching, possibly due to dry conditions, but it may survive if the shell drops off. Occasionally there are problems during development, and a genetic ‘freak’ is produced – a stick insect with three antennae instead of the normal two, or even more startling, a creature with two heads!

Soon after hatching, phasmids begin to eat the leaves of their food plants; the most successful species accept a wide range of leaves. Many Australian species have a tendency to quickly walk upwards, towards



A nymph of the Cape York Stick-insect, *Didymuria virginea*, hatches from its egg.



A male nymph Wülfing's Stick-insect, *Acrophylla wuelfingi*, in the process of moulting.



A newly hatched nymph of the Cigar Stick-insect, *Cigarrophasma tessellatum* (left), moves speedily, but a few days later (right) it has slowed down and changed colour.

the top of shrubs or trees, reducing the risk of predation. This can make things difficult for collectors as nymphs can easily reach branches well out of reach.

Phasmids have what is known as an incomplete metamorphosis – they grow by moulting. This compares with many insects which undergo complete metamorphosis, for example butterflies, with an extra stage known as a chrysalis or pupa. Before reaching the adult stage, phasmids moult five or six times when their skin becomes too tight. The process of moulting takes from five minutes to one hour, and may take place night or day, but is often at night to reduce the risk of attack by predators. In captivity and in the wild, a forthcoming moult can be predicted, as the nymph remains motionless for some time – perhaps clinging upside down on a branch, with no interest in eating. After making the first moult, it is known as a second instar nymph and so on, until it matures into an adult at the final moult. In order to remove any evidence and perhaps

to provide nourishment, a nymph will often eat its discarded skin after moulting. However, no harm comes to nymphs which do not partake. Those species which have wings develop these during the nymphal stages as wing buds.

As phasmids grow, they may lose a leg or an antenna. A leg may be shed if grasped by a predator, or perhaps caught up in prickly vegetation. If a phasmid loses more than three legs, it is unlikely to survive – phasmids are rarely seen in the wild with only two legs. However, while moulting, nymphs have the ability to regrow a leg – a process known as autotomy. When this happens, the regrown leg may be significantly smaller than the others. Even though separated from the body, a discarded leg may twitch for several seconds, confusing a predator, which may end up with nothing else. Very occasionally during the moulting process something goes wrong and a small leg replaces a missing antenna! Adults cannot grow another leg or antenna.



Genetic freaks occasionally happen in the phasmid world: the newly-hatched Macleay's Spectre, *Extatosoma tiaratum*, on the left has two heads, while the one on the right has three antennae.

Adults

A feature of some phasmid species is their ability to reproduce both sexually and asexually. If males are not available, reproduction can take place by means of parthenogenesis, that is the development of unfertilised eggs. Even in parthenogenetic colonies, males are sometimes produced in small numbers, not often capable of fertilisation. Because relatively few Australian species have been reared in captivity, little is known about which species can survive without males. Research on some Australian species indicates that only about one per cent of unfertilised eggs hatch, usually into females only, but occasionally into both males and females. In other species, close to 100 per cent of parthenogenetic eggs are fertile.

In sexual reproduction, mating can last from one hour to a day or more in some species. Transfer of semen is either direct or often by means of a spermatophore (a

sperm package). In the wild many species are found paired up, which can simplify identification to species level as the sexes may look rather different. About two to three weeks after maturing, females are ready to start the life cycle all over again, by laying numerous eggs.

Male or female?

With practice, it is usually easy to distinguish between males and females. The variation between the sexes (known as sexual dimorphism) is sometimes so extreme that it is difficult to accept that they belong to the same species. Males have a characteristic 'bump' (subgenital plate) on the underside of their abdomens, which is absent in females. The operculum in females is boat-like, often fairly flat. In some Australian species, this is extended beyond the end of the abdomen by a chute, such as in the *Eurycnema* species, or ovipositor (*Eurycantha calcarata*).



This specimen of *Extatosoma tiaratum* exhibits gynandromorphism – it is part male, part female, but has mainly female characteristics.

Males are usually smaller than females, often much slenderer. Why? Females are often full of eggs. Males merely need to find them to transfer sperm during mating, hence in winged species males can often fly well, while females may have shortened wings, quite unsuitable for flight. We have observed *Mesaner sarpedon*, *Parapodacanthus hasenpuschorum* and *Spinosipyloidea doddi* flying as well as any bird. *S. doddi* females also carry the paired males in flight. It is believed that females attract males by releasing pheromones (chemicals, rather like a perfume). Caged *Extatosoma tiaratum* females in Garradunga, near Innisfail, Queensland often attract several males from the neighbourhood.

Rarely, gynandromorphs are reared in captivity, or even rarer, observed in the wild. These are insects with part male and part female characteristics.



The spermatophore (or sperm package) of a Cigar Stick-insect, *Cigarrophasma tessellatum*. When empty these are often seen dropped on the floor of the cage of stick insects in captivity.



The tropical rainforest at Mt Lewis in Queensland, home of the Mt Lewis Winged Stick-insect, *Siploidea lewisensis*, and several other species.

2 HABITAT AND ECOLOGY

More than 90 per cent of Australian phasmid species are endemic and they are found throughout the country in a wide range of habitats. They occur in temperate forests where *Eucalyptus* and *Acacia* are prominent, but they are commonest in rainforests, where they feed on a wide range of vegetation that grows in these habitats. While some species are found in temperate southern rainforests and alpine habitats, by far the richest area is north-east Queensland. In fact, more than 60 per cent of all species are recorded from Queensland. The rainforests of tropical

north-east Queensland harbour half of all Australia's bird species and more endemic mammals than anywhere else on the continent; indeed, they are amongst the richest rainforest regions in the world. It is, therefore, not surprising that this wet tropics area is so rich in phasmid species.

Little is known about the preferred food plants of phasmids. They eat leaves and sometimes flowers and stems – alive or dead. They can be found on grasses, bushes or trees, or sometimes resting near their food plants. Whilst it can be hard work finding phasmids, particularly species



The low-growing plants at Iron Knob, South Australia, are home to some unusual species, including Baehr's Stick-insect, *Paractenomorpha baehri*, and short-winged *Sipyloidea* species.



The edge of rainforest at Brampston Beach, north Queensland. Inset: a well camouflaged female Strong Stick-insect, *Anchiale briareus*, on *Casuarina*. In other areas it feeds on a wide variety of vegetation including *Eucalyptus* and *Acacia*.

which often live near the canopies of trees, there are sometimes population outbreaks. Phase differences (kentromorphism) were first reported by Ken Key in three ‘pest’ species, namely *Anchiale austrotessulata* (as *Ctenomorphodes tessulata*), *Didymuria violescens* and *Podacanthus wilkinsoni*, involving protectively coloured nymphs in high density populations. Otherwise are phasmids generally rare, as widely believed?

Many of the winged species are attracted to light, and during a nocturnal insect hunt in Queensland in peak season it is not uncommon to find around ten species on a good night. Even at times of the year when

insects are generally scarce, a night walk may produce a few phasmids. The answer, therefore, appears to be a resounding no, although, as with other Australian insects, distribution of species may be limited by vegetation zones, particularly if they are specialised feeders.

The most successful species, such as *Anchiale briareus* in northern Queensland, adapt to different habitats and accept a wide range of food plants. This in turn may cause them to be variable in size, colour and body form (i.e. number of spines and/or lobes), as different food plants and climate may influence changes.



Phasmids sometimes feed on flowers – this female Wülfing's Stick-insect, *Acrophylla wuelfingi*, is feeding on *Calliandra* flowers.



Left: defoliation of kauri pine, *Agathis robusta*. Right: the culprit, Wülfing's Stick-insect, *Acrophylla wuelfingi*. This individual is a large adult female.



Cyclone devastation near Innisfail, north Queensland, March 2006.



A cyclone survivor – a male Wülfing's Stick-insect, *Acrophylla wuelfingi*.



A remarkably well camouflaged male Kirby's Stick-insect, *Xeroderus kirbii*, at rest on a tree in north Queensland.



This well camouflaged, female nymph Macleay's Spectre, *Extatosoma tiaratum* is mimicking lichen.



A huntsman spider preying on Nelida's Stick-insect, *Sipyloidea nelida*.

In Australia, land clearing has been the major destroyer of habitats. However, unlike many countries around the world, major parts of the country are well preserved and there are no major concerns about conservation of phasmid species (apart from the remarkably low population of *Dryocetus australis*, amazingly still present on Ball's Pyramid). As well as agriculture, forestry, urbanisation, fire and tourism all play a part in reducing the number of phasmids.

Phasmids may have distinct seasons, but some species can be found practically all year round. In the tropics, usually December to March is more productive for adults. The Australian summer months are also usually the best time elsewhere, but species may have favoured breeding seasons. Abnormal weather such as heavy rain can trigger egg-hatching at almost any time of year. Storms such as cyclones can sometimes assist

collectors. In the Innisfail area, a cyclone caused considerable damage in March 2006, resulting in trees being damaged, including much of the rainforest canopy. This in itself can create collecting opportunities, as adults living near the canopy may be blown down from vegetation. Subsequent generations may be easier to find, as a result of lower height of the canopy. Drought adversely affects animal life in general, not just phasmids, so that peak breeding season may be delayed.

Although phasmids are usually well camouflaged and some have elaborate defence mechanisms, they have many natural enemies. They are eaten by animals, birds, spiders, and other insects such as ants, katydids and praying mantids. Australia's most important pest, the introduced cane toad, *Bufo marinus*, is rather fond of them. Some birds are well known for feeding on phasmids, including the pied currawong



A crested hawk feasting on a phasmid – one of its favourite meals.



A mite attached to a Richmond River Stick-insect, *Candovia strumosa*.



Biting midges (Family Ceratopogonidae) on the forewings of a Darwin Stick-insect, *Eurycnema osiris*.



Mites attached to a male Strong Stick-insect, *Anchiale briareus*.

which eats pest species in eucalypt forests of the highlands of eastern Australia. In northern Queensland the crested hawk, which congregates in groups, picks off larger species such as *Acrophylla wuelfingi* and *Anchiale briareus*. It is not easy to photograph the hawks during a kill, as they devour the insects quickly! Rather to his surprise, David Rentz encountered a Red-legged Pademelon near Kuranda in north Queensland feeding on a female *Acrophylla wuelfingi*.

Among the worst parasites of stick insects are nematode worms. The Horsehair

Worm, for example, is a nematode that lives inside the phasmid, feeding on its body fluids and reproductive organs. It can slow the insect's growth and kill it, although usually as an adult. Mites are frequently seen attached to phasמידs, sometimes several to a single phasמיד. Flies and wasps are important parasites of phasמיד eggs, nymphs and adults.

Other dangers for phasמידs include fire and death on the roads. Some forest fires can be catastrophic to phasמיד populations. These factors all contribute towards controlling phasמיד numbers.

3

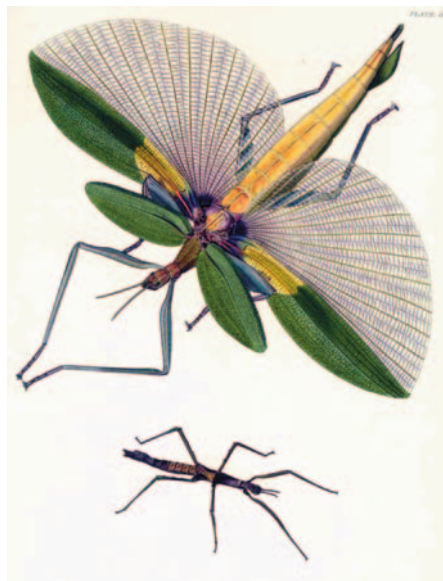
COLLECTING, PRESERVING, PHOTOGRAPHING AND REARING

The first Australian phasmid species were described by William S Macleay in 1826. Macleay had accompanied Captain Philip P. King on his survey of the tropical and western coasts of Australia between 1818 and 1822. When describing *Acrophylla titan* (as *Phasma titan*) Macleay stated ‘This immense insect, which is nearly a foot long, is now for the first time described, although it seems to be not uncommon in New South Wales’. He also described *Extatosoma tiaratum* (as *Phasma tiaratum*) as rare. The Macleay collection (now at the University of Sydney) was brought to Australia by William’s father, Alexander Macleay, in 1825. There is also a selection of Macleay’s phasmids in Edinburgh – the family were keen naturalists, devoting themselves almost entirely to entomology.

George R. Gray, a staff member of the British Museum, was only twenty five when, in 1833, he published *The Entomology of Australia. Part 1. The Monograph of the Genus Phasma*. This work included eight engravings by B Waterhouse, hand-coloured by G Bayfield, after original drawings by Charles M Curtis. It also included a number of new species and details of specimens from the Swan River Colony (Western Australia) collected by Alexander Collie and sent to Mr Children, as well as other specimens collected at various localities and brought to the British Museum by Mr Hunter, the surgeon who accompanied Captain King’s voyages. Gray referred to *Extatosoma tiaratum* (as

Phasma tiaratum) as being ‘found on the sapling gum-trees in the neighbourhood of Paramatta’ – the first record of a food plant of an Australian phasmid.

Gray went on to describe more spectacular phasmids in 1834 (from Melville Island, Swan River and other localities) and, in 1835, published a catalogue of all phasmids. Some of his descriptions are based on specimens in the Children collection (now in The Natural History Museum, London), the Curtis collection (Museum Victoria, Melbourne), and Hope collection (Oxford University Museum).



Tropidoderus childrenii and *Pachymorpha squalida* from *The Entomology of Australia. Part 1. The Monograph of the Genus Phasma* by George R. Gray, published in 1833.

The Hamburg collection includes a number of Australian species, often collected by Edward Dämel for the Godeffroy museum. He is known to have collected in many parts of Australia between 1852 and 1875. The Florentine naturalist and 'gentleman of leisure' Luigi D'Albertis collected for the Museo Civico de Storia Naturale, Genova. Between 1875 and 1877 he based himself at Somerset at the tip of Cape York, where he collected both in Australia and New Guinea.

Frederick McCoy, who was Director of the National Museum, State Palaeontologist and President of the Royal Society of Victoria, published excellent plates on phasmids in his 'Natural History of Victoria' in 1882–1883. These were based on specimens collected by (among others) Professor Halford and Mr Plant.

In the early 1900s Frederick P Dodd gave up fourteen years of bank service to devote himself full-time to his hobby of collecting insects. Known as 'The Butterfly Man of Kuranda', he built up a large collection and supplied numerous specimens to major museums and private collectors. Unfortunately, it appears that few of his phasmids have survived. There are, however, several interesting specimens acquired by the Natural History Museum, London, some of them from Townsville where he once lived.

In 1918 Bror Y Sjöstedt described several phasmids collected on Eric G Mjöberg's Swedish scientific expedition to Australia. Mjöberg was the leader of expeditions to north-western Australia, northern and southern Queensland, and the Coleman River flowing into the Gulf of Carpentaria, on west coast of York Peninsula. The type specimens are deposited in the Naturhistoriska Riksmuseet, Stockholm.

In 1883 the Prussian-born Johann Tepper was appointed natural history collector at the South Australian Museum. Tepper described several species sent to the Museum in Adelaide, some of them collected by H. Basedow in 1903.

A Harvard Museum expedition in 1931–32, which included PJ Darlington, H Heinrich and WM Wheeler, collected a number of phasmids in New South Wales and Queensland. Other Australian material in the Harvard collection includes specimens caught in Cooktown by EAC Olive in 1896.

During the latter part of the twentieth century, Kenneth HL Key built up in Canberra a huge collection of Australian orthopteroid insects, including phasmids, which was at least equal to all other collections of Australian orthoptera put together. He meticulously arranged specimens collected all over Australia by many notable entomologists, mostly on well organised museum field trips. Key also donated a few well set phasmids to the Natural History Museum, London, and identified specimens in this collection during a visit in 1958.

In more recent times, the principal collectors of phasmids in Australia have been Paul Brock, (mainly in Queensland), Graham Brown (mainly Northern Territory around Darwin), William Cooper (mainly in the Topaz area, north Queensland), Allan Harman (Queensland and Western Australia), Tony Hiller (New South Wales and Queensland), Graham Milledge (Queensland, South Australia and Victoria), Geoff Monteith (New South Wales and Queensland), Max Moulds (New South Wales and Queensland). Jack Hasenpusch (mainly in northern Queensland), and David Rentz, who has collected widely



Two wild-caught specimens of Wülfing's Stick-insect, *Acrophylla wuelfingi*. Their size differences are as a result of feeding on different food sources.



Kenneth HL Key at the Australian National Insect Collection, Canberra, in 1963. Key was mainly responsible for building up a huge collection of Australian phasmids.

throughout Australia. Curators of various museums in Australia have added specimens to their collections.

Australian species sent to museums by various collectors during the nineteenth century were mainly described by European specialists, such as Brunner Von Wattenwyl & Redtenbacher (Naturhistorisches Museum, Vienna), Kirby (Natural History Museum, London) and Westwood (Natural History Museum, London & Oxford University Museum). The total number of authors who have described currently valid Australian phasmid species is surprisingly few – only 29 people – see the Checklist of Australian Species (pp. 185–191).

Collecting

It is often not possible to identify different species of phasmids from photographs

alone, as they may not show key features. It is therefore useful to collect specimens, record relevant data to link them with photographs, and preserve them. If one collects females, there is an opportunity to go on to rear them.

Specimens deposited in museum collections can be examined by researchers and dead specimens are essential for description of new species. If one allows specimens to die naturally, there is a risk they will become damaged, or the body may change colour or rot. Collections of identified and properly labelled insects are valuable resources, useful in educating farmers, naturalists, the public and students.

A permit is required to collect insects in many places in Australia, including national parks. It is also illegal to export material



Jiva Sztraka, a young collector, holds a pinned female Jiva's Stick-insect, *Micropodacanthus sztrakai*. The species has been named after him.

without a permit and unauthorised collecting may incur fines. Contact Environment Australia, Canberra or the nearest Environmental Protection Agency office for local advice.

Try collecting in the cooler hours of the day, although this is more of a challenge because stick insects, being nocturnal, are usually well hidden. Look at the vegetation closely in a slow, methodical way. Daylight is ideal for photographing any finds and, with practice and an increasing knowledge of likely habitats and food plants, more success will come. The authors have even had limited success using binoculars to locate specimens. If one comes across a bushfire (and can park at a safe distance) quickly searching for rapid-moving phasmids trying to escape the fire (for example, crossing the

road) may be rewarding, but be aware of the obvious dangers.

Night collecting is likely to be much more productive but requires extra caution. Collecting hazards to be avoided include animals such as snakes, which may be resting on paths and, in some parts of Australia, leeches, ticks and poisonous spiders. Crocodiles can turn up in unexpected places. A basic knowledge about possible hazards is useful, particularly for people travelling on their own.

Always collect sensibly – there is no need to collect every specimen seen, as it is pointless having long series of specimens. However, destruction of habitat is the most likely reason insects become scarce or extinct, not collecting for genuine research purposes.

Equipment

Equipment can be either purchased from entomological suppliers or, in some cases, a home-made alternative can be used. For example, instead of investing in a beating tray, use a large, inverted umbrella. Phasmids are much easier to catch than flying insects, and often only a bare minimum of equipment is necessary, which the collector can carry in a rucksack.

The following is a list of basic equipment needed:

Collecting box

This is needed to transport live collected specimens, which are carefully picked up from vegetation. A ‘small pet’ cage or other plastic container is usually appropriate. Some ventilation is necessary otherwise insects may die in hot weather.

Some collectors use plastic bags, inflating and sealing them. Do not overcrowd specimens as there may be a risk of damage, such as lost limbs. Keep food plant leaves for rearing and/or identification – remembering, of course, that the phasmid may only be resting on plants that happen to be near its food plant.

Killing jar (wide-mouthed glass jar)

This is used to kill specimens, so it may not be needed by some enthusiasts. Use a killing agent such as ethyl acetate, which is supplied by entomological dealers, on cotton wool at the bottom of the killing jar. However, potassium cyanide is better because it has less effect on the colours of the insect, but it is extremely dangerous and difficult to obtain by collectors not associated with a museum or university. (See David Rentz’s 1996 book *Grasshopper Country* for information on making an effective and



A female Wülfing's Stick-insect, *Acrophylla wuelfingi*, photographed at night at Harvey Creek, Bellenden Ker, Queensland.

safe killing jar.) Place the insects directly into the killing jar and leave them in it for at least an hour. Giant species may not be able to fit into killing jars suitable for the field, so they need to be killed by syringe containing the killing agent. The killing agent evaporates when the jar is opened and needs to be replaced on other trips. An alternative to using chemicals is to place phasmids in airtight containers in a deep freeze for at least six hours.

Torch

A powerful torch is essential for night collecting, when phasmids will ‘stand out’ by their general profile, waving antennae or moving legs. They may also be feeding. A slow, methodical search of vegetation is usually most productive – some species may



Sue Hasenpusch using a beating tray to search for *Phyllium* nymphs.



Jack Hasenpusch collecting with a net on an extendable handle.

be found on or near the ground, underneath or on leaves, or on branches. Carry a spare torch, spare bulbs and batteries (preferably rechargeable). Some collectors prefer a head torch, which keeps their hands free.

Advanced collecting equipment includes the following:

Beating tray

To dislodge specimens, hold or place the beating tray beneath branches and sharply beat the branch several times in quick succession using a strong stick. Watch for moving insects on the tray, which may reveal well camouflaged small nymphs.

Net with extendable handle

This is useful to collect specimens which are out of reach, although a broom could be used as an alternative, as the insect can usually be



A light trap set up during the night in the rainforest (left), attracts many insects, including the occasional phasmid, in this case, a male Strong Stick-insect, *Anchiale briareus* (right).

coaxed to cling onto it. A net can also be used to catch winged phasmids in flight, although it is usually better to follow them and pick them up carefully if within reach, taking care not to damage their legs. Using a net may produce limited results in the daytime, after knocking the tops of tall saplings.

Light traps

A light trap is useful in order to catch winged phasmids attracted to light, including rarities such as the giant *Ctenomorpha gargantua* and *Phyllium monteithi*. It is usually males that are attracted to light, but occasionally females turn up. If collecting from a light sheet, using both a strong mercury vapour light and a fluorescent black light is reported to be the most productive. For canopy-dwelling phasmids, a light trap is the most likely means of collecting specimens in season, but be aware that predators such as bats and toads are also out hunting during the night. Also search again early morning (before birds pick off survivors) on and around the light sheet, as well as nearby vegetation. Another option is to collect

at lights, for example in isolated areas, by petrol stations.

Egg traps

In order to collect eggs of canopy-dwelling species, place a canvas egg trap beneath high-growing vegetation. The trap needs to be checked and emptied daily, before ants and other predators find the eggs. The eggs of rare species such as *Phyllium monteithi*, as well as common species, can be collected in this way.

'Assembling' cage

This is a simple net cage in which you place a female, making sure she is secure from predators such as toads and rats. Males will fly to pheromones released by the female so, in early morning, look for males on and around the cage. Later in the day they may fly off or walk away, or birds may find a ready-made meal.

Specialist climbing equipment

To catch insects in the canopy, specialist climbing equipment can be used, but only



Climbing trees in search of a Spur-legged Stick-insect, *Didymuria violescens*, is recommended only for experienced climbers.

by experienced climbers (and not for night work) because of the obvious dangers. Alternatively, it may be possible to work with scientific groups that have access to a canopy lift or crane. It is also worth checking vegetation on recently felled trees for canopy dwellers.

Preserving

The collector needs to decide whether to set specimens immediately, while they are soft, or 'paper' them to set later. Either way, they need to be removed from the killing jar after a few hours as the vapour affects colouration. Phasmids should be preserved dry; occasionally specimens may be preserved in 100% alcohol, but they will lose their colours. However, preserving

at least part of the insect in alcohol, for example a leg, is essential for projects such as DNA barcoding or molecular work. Gutting larger specimens may help to preserve colours.

Setting

The basic equipment needed for setting specimens is as follows:

- setting 'board', preferably a sheet of Plastazote™, expanded polyethylene or cork (at least 15 mm thick),
- 'continental' entomological pins (sizes 3, 4, 5 depending on the size of the specimen) preferably of stainless steel,
- lills (short pins),
- cardboard and setting strips, and
- gelatin capsules (for eggs).

The following is the procedure for setting specimens ready for later transfer to an entomological cabinet or store box.

- Obtain an entomological pin of the correct size. Pin the specimen through the mesonotum (upper surface of mesothorax), just in front of the mid-legs and push the pin through to the base of the setting 'board' at least 15 mm, or longer if required.
- Place pins or lills either side of the metathorax to hold the specimen steady.
- Spread the legs and antennae in the desired position, close to, or in line with the body (in order to save space) and use lills or pins to keep them in position.
- Slightly move the head and/or body if necessary. If the specimen has wings, spread one wing (or both) and place over a piece of cardboard of relevant thickness.
- Use a transparent setting strip to hold the required position (90°) and place



A papered stick insect, ready for setting.

several lills just above and immediately below the outspread wing.

- Eggs can be placed in small gelatine capsules.
- Place a small, neat data label (printed on thin card) by the specimen, for later use.
- Finally, place the board somewhere warm where specimens can dry and harden, perhaps in the sun in the tropics (but monitor them, as keeping them in the sun too long will fade specimens, also ants and other creatures can attack them). Add a pest deterrent, such as naphthalene.

Papering

The basic equipment for papering specimens for setting at a later date, or for exchange is as follows:

- cardboard,
- soft paper e.g. kitchen paper,
- scissors,
- cellophane,
- stapler,
- relaxing box (airtight plastic container), and
- relaxing fluid.

Spread a specimen on soft paper, stapled onto a cardboard backing, cut to size. Cut cellophane to size and staple around the edges of the cardboard. To prevent damage, the specimen should not be movable within the envelope. Place a data label by the specimen, for later use, or record data on the back of the cardboard. When dry, these specimens can be placed in a suitable, airtight container for future setting or despatch. Add a pest deterrent, such as naphthalene.

Storage

There are various options to store stick insects, depending on your available budget. You may keep them in storeboxes, a display case, or an entomological cabinet, fitted with unit trays.

When you are ready to set the stick insects, you will first need to 'relax' the papered specimens by placing them overnight, or for at least three hours, in a relaxing box on a layer of tissue moistened with water or relaxing fluid obtained from natural history equipment suppliers. Then, after setting them, transfer them to storage.

At this stage, ensure the correct data label is added beneath the specimen and identification label. These should be small and neat. It is straightforward to print them out, if necessary reducing them in size on a photocopier or there is even marvellous free software (see 'Mantis' <http://140.247.119.138/Mantis/>) to produce labels and generally have the ability to database and/or digitally image collections. Although fairly expensive, well-made storeboxes or cabinets, with tight-fitting lids, are necessary for housing phasmids. To reduce costs, these can often be bought second-hand. Before sorting and labelling the collection, collectors often

use cardboard boxes as temporary homes. Ideally, any storage needs to be airtight, in order to help keep out unwanted pests, such as dermestid beetles or book lice. Including a small amount of naphthalene in the box will help to deter these pests. Other options are more toxic and their ability may be restricted or they may be banned in some countries. Mould may be a problem in some situations, including temperate climates, so keep your collection in a dry place.

Photography

How often does a subject remain perfectly motionless? The challenge is to take good pictures of the insects in clear focus, in their natural habitat, showing aspects such as their habitat and defensive behaviour. Suitable camera equipment is necessary and many keen entomologists are using a digital single lens reflex camera, combined with a genuine macro lens and macro flash, which adds to the expense. Choose a camera that provides five megapixels upwards, in order to produce sharp, clear pictures, which can be transferred to computer and are suitable for publication.

Macro work requires the camera to be held steady and the Konica Minolta Dynax/Maxxum 5D and 7D paved the way with Anti-Shake technology. The automated settings mean that everything is automatically calculated for a perfect, sharp picture, although it may be necessary to use manual settings when, for example, a particularly thin stick insect mystifies the autofocus system. A tripod is not necessary.

For flash photography, set the camera to f.16 or f.22, which provides additional depth of field (range of sharp focus). Refer to camera manuals for specific guidance on macro work.



A fold-up net cage is useful for transporting specimens.

Although the digital revolution moves ahead rapidly, some enthusiasts prefer to still use a traditional non-digital camera film, and scan the images into a computer.

Framing the subject is also important too. Editing software is useful and can be used to make various adjustments, such as better framing of the subject and slight changes to sharpness and colour.

Rearing

Many phasmids are fairly easy to look after and their living quarters need cleaning only about once a week. Their food plants, however, may need to be replaced more often. Rearing times will vary. In the tropics, for example, phasmids mature much more quickly than in captivity in Europe.

The subject of rearing phasmids is covered in detail in various books, however the following are a few key points:



Sleeping phasmids outdoors on guava. Inset: hazard! – rats have damaged this sleeve.



This well ventilated plastic 'small pet' cage houses several *Acrophylla thoon*.

- Cages for nymphs and adults can range from 'small pet' cages to large commercial or homemade cages. Use tall, well ventilated containers, but bear in mind the conditions in which these insects live, such as temperature and humidity. Do not overcrowd nymphs or adults.
- Newspaper or kitchen paper is useful as a lining for the bottom of the cage.
- You can use a jam jar or similar container to hold the food plant branches, but you should plug the jar at the base of the plants with paper to prevent insects drowning.
- You will need small plastic containers for keeping and hatching eggs. These should have some ventilation – the

simplest is to use fine netting as a lid, secured by elastic bands. The eggs need to be carefully picked up from the frass (droppings) and laid on slightly moist sand or kitchen paper in the container, ready for hatching.

- A plentiful supply of food plants is needed, as phasmids are prolific feeders.

For those particularly keen on phasmids, giant cages and sleeves can be used. 'Sleeving' involves tying suitable material, such as netting, cloth or wire, around phasmids kept on living food plant branches. Whichever method is selected, care needs to be taken regarding temperature and humidity requirements. Ideally, the phasmids being reared should be kept in as near to natural conditions as possible.

Enthusiasts find that good general food plants are *Eucalyptus* species (gum trees) and *Acacia* species, as well as *Leptospermum* species (tea-tree) and the 'black wattle', *Callicoma serratifolia*. In Europe, *Eucalyptus gunnii* is very successful and sometimes bramble *Rubus fruticosus*. However, some food plants are a poor substitute for preferred host food plants. In general, the use of alternative food plants may result in smaller than normal specimens. For example, when *Acrophylla wuefingii* feeds on *Casuarina* in the wild, it tends to be more than a third smaller than normal.

Anyone can make a valuable contribution to science by rearing species and recording the results. Although much of the information in this book is new, there are still many gaps in our knowledge.

4 GUIDE TO SPECIES

Three families of phasmids are currently represented in Australia. Two families, Diapheromeridae and Phasmatidae, contain stick insects, while the third, Phylliidae, contains the true leaf insects.

The Diapheromeridae are small- to medium-sized species. They are usually slender, either with or without wings, and their legs usually lack spines. Their antennae are often longer than their forelegs, with indistinct segments, or very short ones. These features readily distinguish them from members of the often very large, mainly winged Phasmatidae, which have teeth-like fore femora (often on their mid and hind legs also), and their antennae are distinctly segmented, but usually shorter than fore

femora. The third family, Phylliidae, have broadened leaf-like bodies.

Within these three families there are 11 subfamilies with Australian species included. A brief guide to these subfamilies is given on the following five pages.

The guide to the 101 species currently described in Australia begins on page 39. A distribution map for each species shows the approximate range of the species. These maps are based on the authors' knowledge, published papers, discussion with collectors and a review of collecting data from numerous museum specimens. They should only be used as a guide. In many cases, distribution is likely to be more extensive once collecting trips are made to neglected sites.



A species of the genus *Pachymorpha* collected at Piccadilly in the Australian Capital Territory.

Family Diapheromeridae**Subfamily Necrosiinae**

These are often winged, elongate, small to medium-sized insects with long antennae. The male anal segment not split into two lobes. There are around 620 species in this subfamily, mainly in South-East Asia with a few in New Guinea, many with more colourful wings than the 31 Australian species.

[Species on pages 39–69]



Sipyloidea gracilipes, male and female

Family Diapheromeridae**Subfamily Pachymorphinae**

These are wingless species either remarkably slender species with short antennae, or rather stouter-bodied. Antennae are shorter than fore femora. This large subfamily of around 210 mostly small species is found in Africa, Europe, the Middle East and Asia. The four Australian and New Zealand species are rather understudied, stout-bodied insects, all belonging to the tribe Pachymorphini.

[Species on pages 70–73]



Acanthoderus spinosus, male and female

Family Phasmatidae

Subfamily Eurycanthinae

A group of robust, small to large, spiny, dark brown or black wingless, spiny species with long antennae. Females often have a beak-like ovipositor, designed for laying eggs in the soil. There are only three Australian representatives in this subfamily of around 102 species, found mainly in New Guinea and the Western Pacific. There is a captive breeding programme in place to help conserve the spectacular Lord Howe Island Stick-insect, *Dryococelus australis*.

[Species on pages 74–78]



Dryococelus australis, female

Family Phasmatidae

Subfamily Lonchodinae

These are remarkably slender, wingless insects with long antennae, often found near the ground, or in tall grasses. The male anal segment is split into two lobes or has two finger-like processes. There are around 280 species in this subfamily, found mainly in South-East Asia and New Guinea. The 10 Australian species are rather understudied and variability within species can be considerable.

[Species on pages 79–88]



Austrocarausius mercurius, male and female

Family Phasmatidae

Subfamily Phasmatinae

There are 31 Australian species of this subfamily of 62 species, otherwise from New Guinea, rarely Asia. They are mostly winged, robust, stick-like insects, at home in woodlands, gardens, parks, in dry country and rainforests. The antennae are moderately long. The fore femora are triangular in cross-section; serrate at least at the base. The mid and hind femora are often very serrate.

[Species on pages 89–120]



Acrophylla wuelfingi, females (miniature form on right)

Family Phasmatidae

Subfamily Platycraninae

There are two Australian representatives of this subfamily of 59 species mainly from Pacific Islands, including the spectacular bluish-green Peppermint Stick-insect, *Megacrania batesii*, which live in the midribs of pandanus leaves. The species are stout, with shortened or vestigial wings. The antennae of moderate length.

[Species on pages 121–123]



Megacrania batesii, male and female

Family Phasmatidae**Subfamily Tropidoderinae**

The Australian representatives of this robust group of 30 species are often associated with eucalypts. Antennae are moderately long, although shorter than the femora in some females. Wings are well developed in most cases, but shortened in females of some genera. The fore femora are not triangular in cross section, nor compressed at base. The mid and hind legs are finely serrate or smooth.

[Species on pages 124–144]



Tropidoderus childrenii, male

Family Phasmatidae**Subfamily Xeroderinae**

This is a group of 20 Melanesian and New Guinean winged species, with moderately long antennae. There is only one Australian representative – it occurs on eucalyptus bark and branches in Queensland where it is remarkably well camouflaged. The femora have blunt teeth or lobes; the fore femora are distinctly compressed at the base.

[Species on page 145]



Xeroderus kirbii, female

Family Phylliidae

Subfamily Phylliinae

These are the true broad-bodied, leaf insects, found mainly in South-East Asia and Australasia (46 species). There are only three, rare Australian species, found in the rainforests of northern Queensland. The legs and body are flattened and leaf-like. Males have long and bristly antennae, but shorter than the fore femora. Females (and nymphs of both sexes) have tiny antennae, hardly as long as the head.

[Species on pages 146–148]



Phyllium monteithi, male

Austrosipyloidea carterus

Black-striped Stick-insect

BL: male 66–75 mm, female 97–110 mm.

Identification: Both male and female are pale brown and elongate with full length wings. A black central stripe along the length of the body and the remarkably long cerci easily distinguish this species. A look-alike species, *Sipyloidea gracilipes*, found in northern Queensland has a similar black longitudinal body stripe, but it lacks the long cerci of *Austrosipyloidea carterus*. There is also an intermediate 'form' near Millstream in Western Australia, which has cerci of an intermediate length. Identification is more difficult if the fragile cerci have become detached.

Habitat: This species favours dry eucalypt country and is widespread in parts of Northern Territory (for example Kakadu National Park) and south-east to northern Queensland, feeding on *Eucalyptus* species. **Note:** When disturbed, females open their wings to reveal a small, striking, bright yellow basal margin on the wings, in addition to large bold, black blotches on abdominal segments one to five. Both sexes can glide between trees and their colour helps them 'vanish' amongst the vegetation, where they look rather like dry grass.



female and eggs (inset)



male



large female nymph

Candovia aberrata

Aberrant Stick-insect

BL: male 58–61 mm, female 73–76 mm.

Identification: This is an elongate species with attractive black central markings on its abdominal segments. The male has a black 'V' on its head between its eyes. The mesonotum of the female has several tubercles on its sides. **Habitat:** The type specimens were collected at the Richmond River in northern New South Wales. The species is distributed in New South Wales (for example Jenolan Caves), and is also found in Queensland, including North Stradbroke Island.



male and female (courtesy NHMW, Vienna)



male

Candovia annulata

Banded-legged Stick-insect

BL: male 53 mm, female 80 mm.

Identification: This is a dark, elongate species, which is easily recognisable by whitish bands on its head and on the femora. The mesonotum and metanotum of the male also have whitish bands. **Habitat:** Distributed in New South Wales, it is found also in Queensland, for example on Mt Tambourine. The type specimen for this species was collected at the Richmond River in northern New South Wales.



male and female



male

Candovia coenosa

Muddy Stick-insect

BL: male 60 mm, female 83 mm.

Identification: This is a fairly plain, elongate, brown species, with longer mid legs than others in the genus. **Habitat:** It is only known from few parts of New South Wales, including near Bungonia and Kurri Kurri.



male



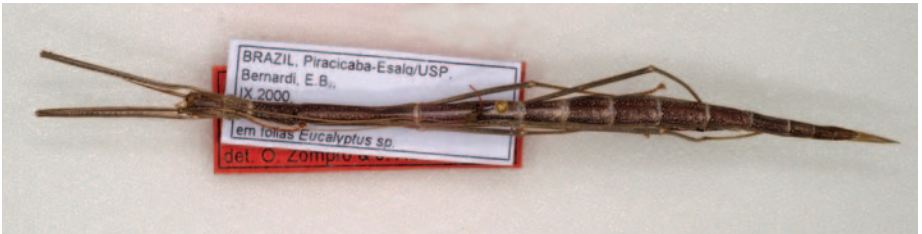
female and eggs (inset)

Candovia evoneobertii

Evoneoberti's Stick-insect

BL: male not known, female 65 mm.

Identification: This is a small, smooth species, coloured green, grey or brown. It has long cerci, and can easily be confused with *Candovia peridromes*. **Habitat:** The classification of this species is questionable. It is thought to have been introduced to southern Brazil from Australia on *Eucalyptus urophylla* and may, along with related South American species, belong near *Paracalynda*. The species has been recorded from Lake Entrance, New South Wales, but the specimen appears to have been misidentified.



female paratype from Brazil (courtesy ANIC, Canberra); egg (inset)

Candovia granulosa

Granulated Stick-insect

BL: male 50 mm, female 63 mm.

Identification: This is a stocky, wingless species, often brown, sometimes green. Its abdomen is heavily ridged.

Habitat: First collected near the Richmond River, it is distributed in New South Wales and is not uncommon in collections from localities such as Nundle State Forest (altitude 1200 metres).



males (two colour forms) and female



eggs

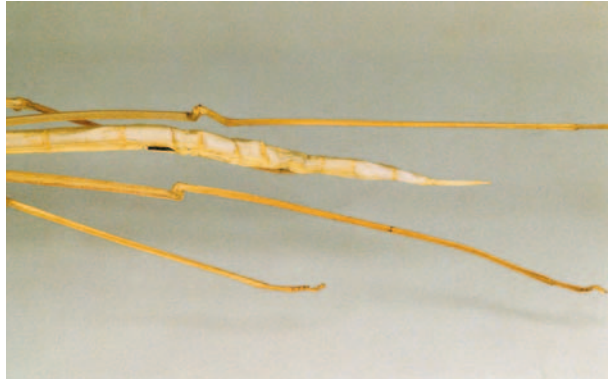
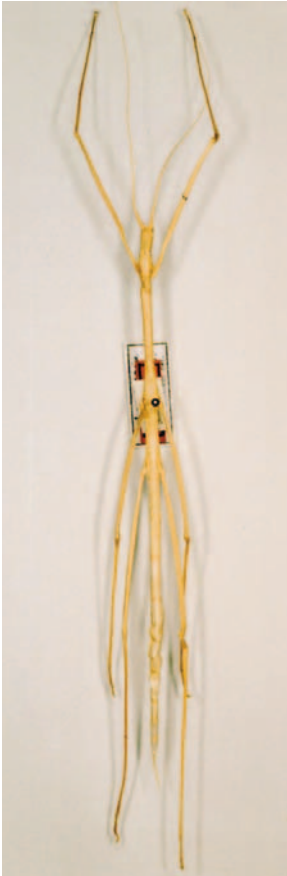
Candovia pallida

Pale Stick-insect

BL: male 79 mm, female 100–118 mm.**Identification:** This is an elongate, green or brown species with a mesonotum about six times the length of its pronotum.

It has long cerci, twice the length of the anal segment in the female, but the same length as the anal segment in the male.

The greenish-brown male has a green band from eyes to the back of its head.

Both male and female have a black, partially broken, lateral line on the thorax. Apart from size, females rather more elongate than *Candovia peridromes* with longer antennae. **Habitat:** Little is known about this species. The type specimen was collected at Broome, Western Australia. It is also known from Barrow Creek and Glen Helen Gorge in the Northern Territory; as well as Roebourne in Western Australia.

holotype female (left and above) (courtesy NHRS, Stockholm)

Candovia peridromes

Sydney Stick-insect

BL: male 50 mm, female 67–72 mm.

Identification: This is an elongate species, very similar to *Candovia pallida*, but smaller and less elongate. The female varies in colour from green to brown and reddish-brown and has long cerci. **Habitat:** This fairly delicate species is found in New South Wales, South Australia and Victoria.

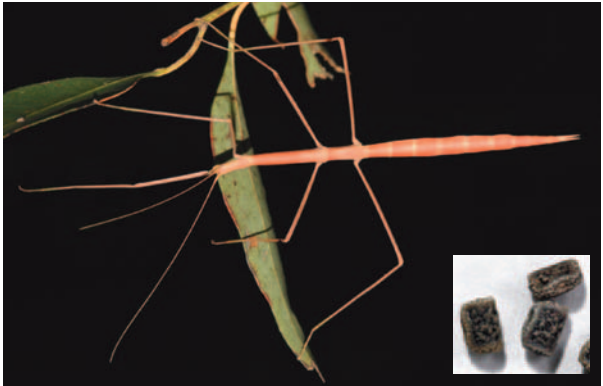
In South Australia it inhabits the mallee scrub behind dunes on the Yorke Peninsula. At the Morwell National Park, Victoria, it has been found on *Acacia verniciflua*. In captivity it feeds on *Eucalyptus*.



male and female



female



female, reddish-brown colour form; eggs (inset)

Candovia robinsoni

Robinson's Stick Insect

BL: male 40–42 mm, female 52–62 mm.

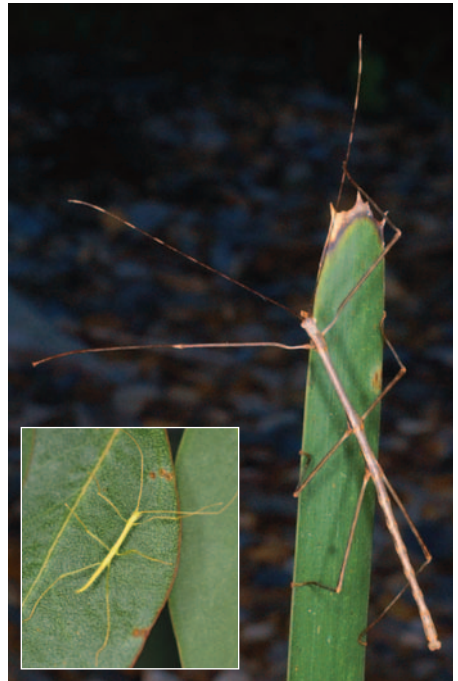
Identification: Males are small, slender, and dark brown, slightly mottled with darker flecks. Females are small, plump, usually dark green and fairly plain, but a darker form, mottled with darker flecks has been noted. Mouthparts are orange. The abdomen of the female is ridged. **Habitat:** This

species has been found in pockets of temperate rainforest in a small part of the Southern Highlands, New South Wales, near Robertson, but is likely to be reasonably widespread. It is a versatile feeder and has been observed on *Acer palmatum* (Aceraceae), *Doryphora sassafras* (Monimiaceae), *Hypericum* (Clusiaceae), *Magnolia* (Magnoliaceae) and *Rosa* (Rosaceae). It has also been found feeding on *Lomandra* (Lomandraceae), an unusual phasmid food plant, and numerous specimens were found on a small *Hypericum* shrub along a roadside.

Note: In captivity, under different conditions, a few unusually dark-coloured insects gradually changed colour to revert to a more common colour form. The orange mouthparts in females may be a warning to possible predators. When disturbed, these stick insects readily emit a secretion, otherwise they remain remarkably well hidden in the daytime.



female and eggs (inset)



male and newly hatched nymph (inset)

Candovia spurcata

Blue Mountain Stick-insect

BL: male 43–44 mm, female 68 mm.

Identification: This is an elongate, dark brown species, which is easily recognised by the tubercles on its mesonotum in both males and females. **Habitat:** This little-known species has been described from a male ‘from Australia’ in poor condition but since found in the Blue Mountains in New South Wales.



male



female



female head and thorax



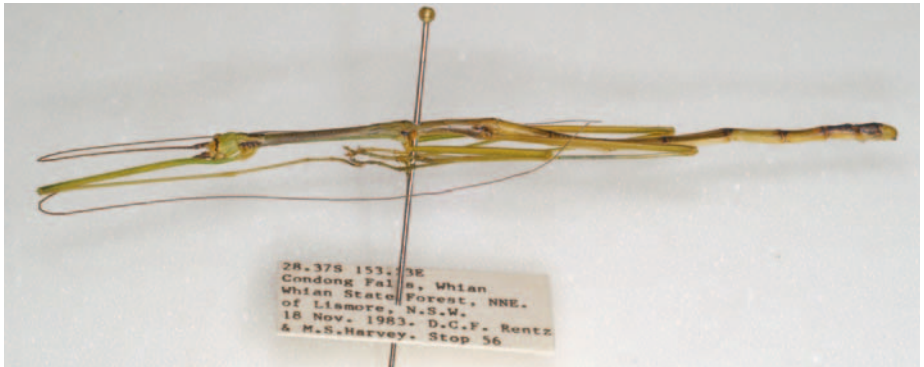
eggs

Candovia strumosa

Richmond River Stick-insect

BL: male 50 mm, female 59–61 mm.

Identification: This elongate, variably coloured species is easily recognised by the swollen sixth abdominal segment in the female. **Habitat:** Distributed in New South Wales, it is probably fairly widespread. The type series was collected at the Richmond River.



male



female



eggs

Cornicandovia australica

Lord Howe Horn-headed Stick-insect

BL: male not known, female c. 56 mm.

Identification: This is a small, green, elongate, horn-headed species without wings.

Habitat: It is known only from the original type specimen from Lord Howe Island.



holotype female (courtesy NMW, Vienna)



female head



female, end of abdomen

Leprocaulinus insularis

Thursday Island Stick-insect

BL: male not known, female 140 mm.

Identification: This is a large, elongate, granulated, wingless stick insect with a mesonotum almost six times the length of its pronotum and two and a half times the length of its metanotum. It has a raised crest on its head, between the eyes. Its abdomen is ridged. Its fore femora are uneven; its fore tibiae are very broadened and its fore tarsi have a broad lobe. Its operculum is shaped like an inverted triangle, with the second half slightly lobed. **Habitat:** The type specimen of this species was collected on Thursday Island. Female nymphs have also been collected on Lizard Island.



holotype female (courtesy BMNH, London)



female, head and thorax



female, end of abdomen



egg

Malandella queenslandica

Queensland Malandella Stick-insect

BL: male 41–46 mm, female 50–56 mm.

Identification: This is a small, attractive, pale green species, with whitish wings. The upper half of its mesonotum has four to six conspicuous orange spines, often black-tipped.

Habitat: This species from northern Queensland is fairly uncommon and can be overlooked, as it is a specialised feeder on *Litsea leefeana* (Lauraceae). Early in the spring, large numbers of nymphs and adults can be found on this plant, also on *Pittosporum tobira* (Pittosporaceae).



male



female and eggs (inset)

Mesaner sarpedon

Dark-winged Stick-insect

BL: male 67–78 mm, female 70–97 mm.

Identification: This attractive, black and brown or grey, mottled species, has a black central line running the length of its body. Its forewings and the pre-anal part of its hind wings are very mottled; the hind wings are brown, and darker towards the outer margin. Its legs are banded black and pale brown or whitish; its cerci are long and leaf-like. **Habitat:** It is occasionally found in south-east Queensland, for example Deception Bay, also northern Queensland at Georgetown and elsewhere. **Note:** Both males and females are attracted to light. Adults can be found resting on black or dark-coloured tree trunks during the day where they are extremely well camouflaged. They regurgitate a smelly fluid upon handling and will readily fly away.



male



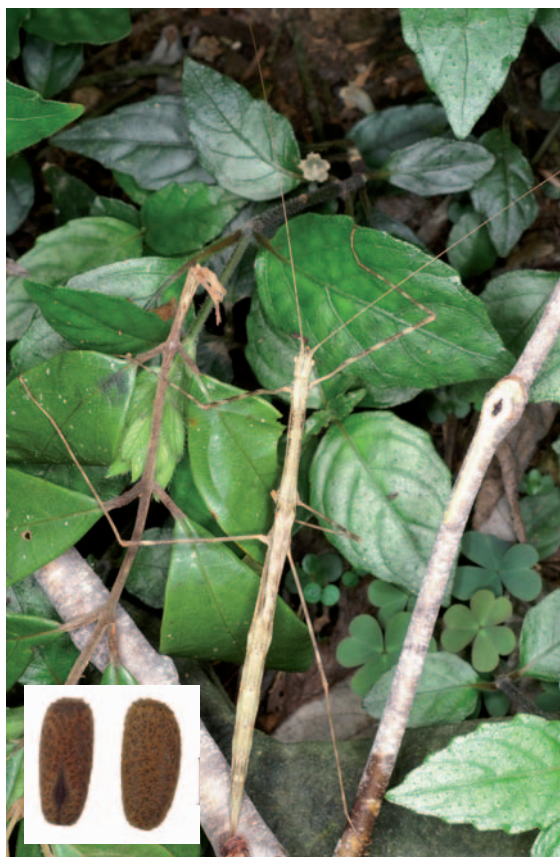
female and eggs (inset)

Rhamphosipyloidea palumensis

Paluma Winged Beak-abdomen Stick-insect

BL: male not known, female 71–80 mm.

Identification: This is a slender, brown species with short wings that are mottled with darker flecks and lines. Its femora and tibiae faintly banded. It has a few sparse granules and short tubercles on its mesonotum. The end of its abdomen is beak-shaped. The female is easily distinguished from the gaudier *Rhamphosipyloidea queenslandica* by its lack of the large, conical spine-like tubercles on its mesonotum. **Habitat:** So far it has been found only in rainforest in Paluma, northern Queensland, but it is likely to be reasonably widespread. It has been found on *Melastoma* (Melastomataceae) but readily accepted raspberry leaves (*Rubus* sp.) in captivity.



female and eggs (inset)



large female nymph

Rhamphosipyloidea queenslandica

Queensland Winged Beak-abdomen Stick-insect

BL: male 50–54 mm, female 82–85 mm.

Identification: This is an attractive, dark brown species, mottled in lighter colours, with conspicuously banded legs. The mesonotum of the male has sparse tubercles; in the female they are large and spine-like. **Habitat:** This uncommon rainforest species is found in parts of northern Queensland and was first collected at Cedar Creek. It has also been collected at Mission Beach, Palmerston National Park, Topaz, and on Mt Lewis eating *Solanum dimorphispinum* (Solanaceae).



male

male and female; eggs (inset)

Scionecra milledgei

Milledge's Stick-insect

BL: male 64–65 mm, female 90–95 mm.

Identification: This is an elongate, dark brown, indistinctly mottled species, with short cerci. It has brown hind wings.

Habitat: So far it has been only found in and around Paluma, northern Queensland, where it has been observed feeding on *Eucalyptus* (Myrtaceae) in dry woodland. **Note:**

Initially this species was thought to be a size variant of the variable *Scionecra queenslandica*, but its eggs are quite distinctive (the sculpturing is not present in *queenslandica* eggs), as well as other features (see the key on page 154).



male



female and eggs (inset)

Scionecra queenslandica

Queensland Scionecra Stick-insect

BL: male 43–68 mm, female 67–102 mm.**Identification:** This is an elongate, dark brown, indistinctly mottled species with very short cerci, a rather long abdomen, and brown hind wings. The hind legs of the female are short.**Habitat:** Described from Atherton, Herberton and Yarrabah, this species is also found elsewhere in northern Queensland. It is attracted to light and is occasionally found in rainforest habitat, at least as far north as Cape York. In some parts of its range, such as Kuranda, males are very small.

male



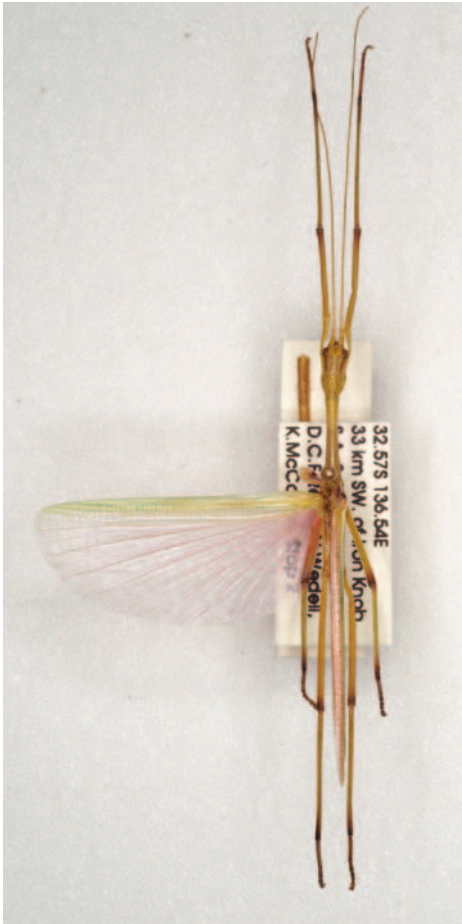
large female nymph and eggs (inset)

Sipyloidea bella

Beautiful-winged Stick-insect

BL: male 45–52 mm, female 56–63 mm.

Identification: This is a small, pale, greyish-green, slender, delicate species. The male has pinkish hind wings, which are very short in the female. **Habitat:** First described from arid northwestern South Australia, it was later reported from near Iron Knob and Port Augusta, feeding on *Acacia* species. **Note:** This species reproduces sexually. The male has a chromosome count of 35, and the female 36. Its eggs are laid in soil, unlike the closely-related *Sipyloidea nelida* and *Sipyloidea similis*.



male



female

Sipyloidea brevicerci

Short-cerci Winged Stick-insect

BL: male 54 mm, female 66–82 mm.

Identification: This is a fairly stocky, robust-looking, dark brown, mottled species with short cerci. Its legs are indistinctly banded in lighter and darker shades. Although it is similar in appearance to *Sipyloidea larryi*, its eggs indicate an affinity with *Sipyloidea garradungensis* – it is possible the species has a hybrid origin. **Habitat:** So far it has been found only in rainforest in Garradunga, northern Queensland, where it has been observed feeding on rainforest plants, including *Brombya platynema* (Rutaceae). **Note:** It is fairly easy to rear, and will feed on *Rubus* (Rosaceae).



female at rest and eggs (inset)



male and female (courtesy QM, Brisbane)



female defensive display

Sipyloidea caeca

Confused Winged Stick-insect

BL: male 46–53 mm, female 66–75 mm.

Identification: This is an elongate, dark brown, indistinctly mottled species. Both male and female have moderately large, translucent, slightly dusky-brown hind wings, which reach beyond the end of fifth abdominal segment in the female, and the sixth in the male. **Habitat:** This species

has been collected in several rainforest areas in northern Queensland, including Bellenden Ker, Cairns, Garradunga and Kuranda, and is probably fairly common. It feeds on various rainforest plants, including flowers. Males often approach vegetation edges, two to three metres high up, and readily fly away. At Garradunga the species has been observed feeding on guava, *Psidium guajava* (Myrtaceae). **Note:** *Sipyloidea caeca* appears to be rather fragile, and is readily prepared to shed one or more legs. It accepts *Eucalyptus* in captivity.



male



female and eggs (inset)

Sipyloidea garradungensis

Garradunga Green-winged Stick-insect

BL: male 45–57 mm, female 60–77 mm.

Identification: This is a slender, uniform mid-green species with short cerci. Its wings are shortened, particularly those of the female. **Habitat:** This species has been found only in northern Queensland, from Garradunga to the Atherton Tableland. It has been observed feeding on rainforest plants and is fairly easy to rear, including on raspberries, *Rubus* (Rosaceae), and *Eucalyptus* (Myrtaceae). **Note:** It is quick to take flight, or else females use a startle display, flashing open their yellowish hind wings and holding them open for several seconds. Its eggs indicate that it may be closely related to *Sipyloidea brevicerci*, but it is very similar in general appearance to the larger *Sipyloidea rentzi*, which has considerably longer cerci.



male



female and eggs (inset)

Sipyloidea gracilipes

Graceful-winged Stick-insect

BL: male 58–65 mm, female 91 mm.

Identification: This is an elongate species with short cerci and a narrow, black stripe on its head and pronotum. It is very similar in general appearance to *Austrosipyloidea carterus*, which has long cerci. **Habitat:** Described from Cape York in northern Queensland, it is also common in rainforest habitat in Cooktown and open forest at Mt Garnet.



mating pair and eggs (inset)

Sipyloidea larryi

Hurricane Larry Stick-insect

BL: male 53–60 mm, female 76–85 mm.

Identification: This is a fairly stocky, robust-looking, mid-brown species with moderately long cerci. It has mottled wings with dark blotches and indistinctly mottled legs. The length of its cerci and the three black spots between its eyes enable it to be distinguished from *Sipyloidea brevicerci*, whose eggs are also quite distinct.

Habitat: It has been found feeding on low-growing plants in rainforest in northern Queensland. While very similar in appearance to *Sipyloidea brevicerci*, it is commoner in some years than others, and appears to be much more widespread. **Note:** It is sometimes found paired and readily takes flight. In captivity, it will accept a wide range of plants, including *Acronychia acidula*, *Eucalyptus*, *Meliocope elleryana*, *Psidium guajava*, and *Rubus*. The species was named after cyclone Larry, which devastated the town of Innisfail and much of its surrounding rainforests in March 2006.



male and female mating pair; eggs (inset)



female, plain form

Sipyloidea lewisensis

Mt Lewis Winged Stick-insect

BL: male 50–51 mm, female 64–74 mm.

Identification: The male is slender, dark brown, indistinctly mottled (particularly on its legs) with moderately long cerci. The female is similar except is much broader, paler brown with more granules and tubercles on its head, pronotum and mesonotum. The hind wings of the female are rather short, only reaching to about half of its fifth abdominal segment. The species is easily distinguished from similar brown, mottled *Sipyloidea* species, by the heavily granulated and tuberculate head, pronotum and mesonotum. **Habitat:** So far it has been found only in rainforest on Mt Lewis, northern Queensland, feeding on low-growing rainforest plants. Mt Lewis is a dense rainforest habitat, regarded as a Gondwanan refuge area, with high altitudes and many endemic plants and insects.



holotype male



female paratypes



female, head and thorax

Sipyloidea nelida

Nelida's Stick-insect

BL: male 42–55 mm, female 60–75 mm.

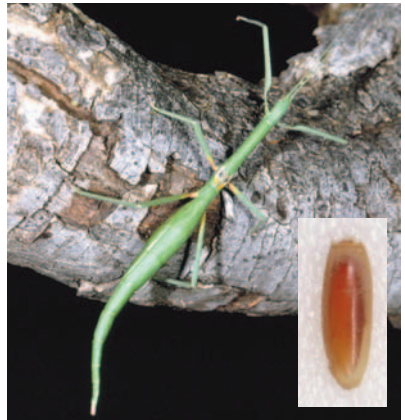
Identification: This is a small, pale, greenish-grey species with a powdery grey overcast. The male has largely black forewings and pinkish hind wings. The wings of the female are very short. The species is similar to *Sipyloidea similis* but it has longer, more slender cerci. **Habitat:** It is widespread in arid parts of Western Australia (for example, near Kalgoorlie), and is also found near Yalata Mission, South Australia. **Note:** This species has a chromosome count of 37 (male) and 38 (female), but research has identified females with counts of 57, 58, 68 and 69, which are capable of parthenogenetic reproduction. The egg is unusual, as it is enclosed in two thin membranes, which rupture and the operculum ‘explodes’ into a ring of hairs, resembling the head of a dandelion. They are similar to the eggs of *Sipyloidea similis* and are laid under the bark of host plants, usually *Acacia* species, as well as *Cassia nemophila*.



male



female, brown colour form



female and egg (inset)

Sipyloidea rentzi

Rentz's Sipyloidea Stick-insect

BL: male 57–60 mm, female 84–85 mm.

Identification: This is an elongate, dark green, long-winged species with long, thin cerci. It is closely related to *Sipyloidea garradungensis*, but is more elongated with much longer cerci. The wings of the female are also much longer than those of the female *S. garradungensis*. **Habitat:** Rainforests in northern Queensland, including the Atherton Tablelands, Kuranda range and Daintree regions.



mating pair and eggs (inset)

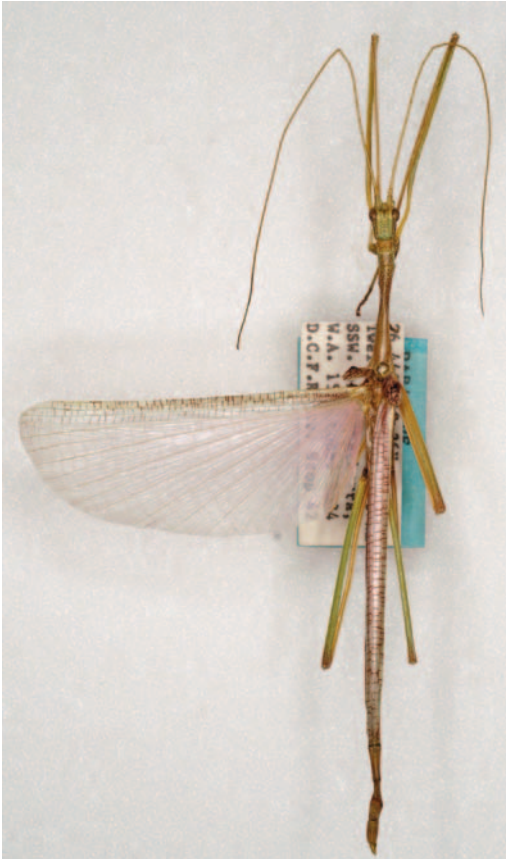
Sipyloidea similis

Similar-winged Stick-insect

BL: male 44–55 mm, female 64–82 mm.

Identification: This small species is mottled grey to greenish-grey. The male has largely black forewings and pinkish hind wings. The female's wings are very short and variable in length. It is similar to *Sipyloidea nelida* but has shorter, more robust cerci than *S. nelida*. **Habitat:** Widespread

in arid parts of Western Australia with a more northerly distribution than *S. nelida*. **Note:** The species has a chromosome count of 35 (male) and 36 (female), but there are females with counts of 57 and 58, which are capable of parthenogenetic reproduction. *Sipyloidea similis* feeds on various *Acacia* species and lays its eggs under the bark of the tree. The eggs have an opercular ring of hairs, similar to *S. nelida* and are virtually indistinguishable from them.



male (courtesy ANIC, Canberra)



female and egg (inset)

Sipyloidea whitei

White's Winged Stick-insect

BL: male 44–64 mm, female 61–68 mm.

Identification: The male is slender and dark brown with its body, legs and antennae indistinctly mottled. The female is similar except it is much broader and can be paler. Its wings are relatively short, only reaching about half the length of its fifth abdominal segment. Both have a bold black central longitudinal line which runs the whole length of the body. **Habitat:** Although only known from several localities, this species appears to be fairly widespread in New South Wales, South Australia, Victoria and Western Australia.



holotype male (courtesy ANIC, Canberra)



female

Spinosipyloidea doddi

Dodd's Spiny Stick-insect

BL: male 43-44 mm, female 78-88 mm.

Identification: This is a stocky, long-winged brown species. The female has a spiny mesonotum; that of the male has numerous tubercles. The hind wings are whitish, black tessellated in the female, whitish in male. This species is easily distinguished by the thoracic spines and the tessellated wings of the female. **Habitat:** Rainforest canopy in northern Queensland. It appears to be a specialised feeder on *Alstonia muelleriana* (Apocynaceae), a common rainforest pioneer which grows very tall. Few other insects appear to feed on this tree as it exudes a milky sap from any part of the tree that has been eaten, or damaged. **Note:** The hairy eggs are extremely unusual in appearance and attach themselves to the hairy host plant leaves.



female and male, mating pair



female and eggs (inset)



large female nymph

Acanthoderus spinosus

Spiny Acanthoderus Stick-insect

BL: male 77 mm, female 89 mm.

Identification: This is an attractive, spiny, robust-looking species. The female can be green, but is more usually whitish-brown. The female's head is white with a broad, dark, longitudinal band running the whole length of its body, and there are brown lines on its head, thorax and abdomen. Her legs and spines are brown. The male is much more slender, glossy and brown. It may have a broken, whitish, lateral line along its thorax, and deep pink areas above mid and hind legs.

Habitat: Originally described from Swan River, this species is found in Western Australia, north from Perth, for example west of Eneabba.



male, head and thorax



male, end of abdomen



female, head and thorax



female, end of abdomen



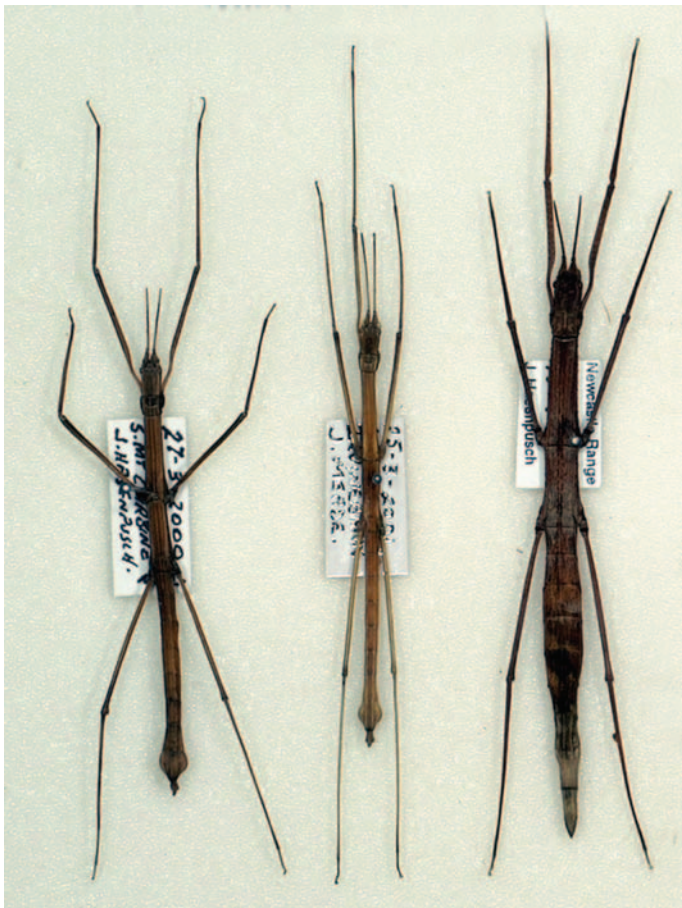
female and eggs (inset)

Pachymorpha simplicipes

Simple Pachymorpha Stick-insect

BL: male 41–43 mm, female 51–60 mm.

Identification: This is a rather plain, small, brown, slightly mottled, elongate species with sparse tubercles. The male has a narrow prong-like anal segment at the end of its final abdominal segment which is rounded. **Habitat:** This species occurs in the Northern Territory and Queensland. Records from New South Wales, South Australia and Western Australia are doubtful and probably belong to an as yet undescribed species.



males and female

Pachymorpha spinosa

Spiny Pachymorpha Stick-insect

BL: male not known, female 69 mm.

Identification: This is a robust-looking, medium-sized, dark brown, mottled species, with tubercles and ridges along the length of its body, and with a regular series of tuft-like spines. It is easily distinguished from other *Pachymorpha* species by its heavily spined head, thorax and abdomen. **Habitat:** It is known from near Alice Springs (Northern Territory) and South Australia, where it was found on *Pilotus obovatus* (Amaranthaceae). It has also been found on *Casuarina pauper* (Casuarinaceae).



holotype female (courtesy ANIC)



female

Pachymorpha squalida

Rough Pachymorpha Stick-insect

BL: male 46 mm, female 54 mm.

Identification: This is a greyish-brown, stout species, slightly wrinkled, and with a few granules or tubercles and raised lines. The male has large, rounded lobes between its eyes, raised lines on its abdomen, with strongly elevated eighth and ninth abdominal segments. When viewed from the side, this species is easily distinguished from other *Pachymorpha* species by its stout form and the shape of its final abdominal segments. **Habitat:** This species is found in New South Wales, for example at Bateman's Bay. A similar species occurs in Victoria.



male



female and male



female, end of abdomen; eggs (inset)

Dryococelus australis

Lord Howe Island Stick-insect

BL: male 100–112 mm, female 120–133 mm.

Identification: This species is unmistakable. It is large, dark brown to black, heavy bodied, and wingless. The male is armed with two larger conspicuous spines in the upper half of its hind femora. **Habitat:** Described from Lord Howe Island, a small volcanic island in the Tasman Sea, 770 km north-east of Sydney, the species used to be abundant, frequenting hollow trunks of living trees and feeding at night. Its story is remarkable. By about 1930 it was believed to be extinct, probably due to predation by rats which had been introduced to the island in 1918 via a trading vessel. Then in the 1960s remains of the species were found on Ball's Pyramid, a 548-metre-high, rocky pinnacle, 23 km south-east of Lord Howe Island. Finally in 2001, two females and one female nymph were rediscovered on Ball's Pyramid, feeding on Lord Howe Island Melaleuca, *Melaleuca howeana* (Myrtaceae). A second survey in 2002, revealed 24 live specimens, mostly females, but at least two males. The species is officially classified as endangered. **Notes:** Males are aggressive, and frequently mate with females, sometimes standing guard. Specimens of both sexes often congregate on top of each other, which is typical behaviour in the related *Eurycantha* species. Active at night, each female lays around 300 eggs, in small batches of 9–10 eggs, pushing their abdomens into the soil. As in *Eurycantha*, there is usually a gap between egg-laying sessions, of about 10 days. The large eggs are pale cream when laid, hatching in six and a half months; eggs become dark brown to black in contact with moisture, or when no longer viable. Newly hatched nymphs vary between 16–22 mm in length (average 20 mm); the bright green nymphs change colour in due course to brown through successive moults. Adults are invariably black, although museum specimens are often reddish-brown. Live adults are more reddish-brown under artificial light. As yet there is no evidence of this species reproducing parthenogenetically in captivity. **Breeding programme:** An effective breeding programme is in place to contribute towards the conservation of this amazing species. The insects are lovingly cared for in temperature and humidity controlled greenhouses at the Melbourne Zoo and elsewhere. They feed successfully on Banyan trees *Ficus macrophylla columnaris* (Moraceae), Tree Lucerne (*Chamaecytisus prolifer*), Blackberry (*Rubus fruticosus*), Callistemon (*Callistemon viminalis*), Lemon Tree (*Citrus limon*), Mountain Correa (*Correa laurenciana*) and Woody Tea Tree (*Leptospermum lanigerum*).



Ball's Pyramid



small female nymph



male



female and egg (inset)



male



large female nymph



female

Eurycantha calcarata

Giant-spiny Stick-insect

BL: male 100–125 mm, female 120–150 mm.**Identification:** This dark brown, sometimes almost black (but rarely green), robust-looking, spiny, wingless species is easily recognisable by the powerful female's beak-like ovipositor. The male's powerful, broadened hind legs include large, spur-like spines on the underside of the femora. **Habitat:** Only a few specimens have been reported from northern Queensland, including some museum specimens from the Endeavour River in far north Queensland. However, no specimens have been reported in Australia since the early 1900s. The species (originally found on Thursday Island and named *Eurycantha sifia*) is most likely to be found in rainforest. It is widespread throughout Papua New Guinea and surrounding islands, including New Britain, New Island and the Solomon Islands. Like *Dryococelus*, it concentrates in tree hollows, sometimes in good numbers. It can be a pest on coconut palms. **Notes:** This species is easy to keep in humid conditions on *Quercus*, *Rubus* and many other plants. Females lay about 400 eggs in soil (provide a small tub with 4 cm of peat or sand). The eggs hatch in four to six months and care should be taken to ensure eggs do not become mouldy. Nymphs mature in about six months, moulting five or six times and like to hide under bark. Adults live about a year. Both sexes are aggressive and need to be handled carefully. Behaviour is very elaborate. When disturbed, the male emits a powerful chemical secretion from the end of his abdomen. He raises his hind legs then brings them down, pincer-like, on any potential predator. If this is a human finger, it may draw blood. At this stage the insect may remain in an aggressive stance, or quickly walk away. It is not just predators that face such behaviour. Rival males can bang their abdomens, corner each other and lock legs; in extreme cases, this results in death. Not to be outdone, females can be aggressive to males, kicking out at them and causing them to retreat. If keeping this species as a pet, they should be kept separate from other species; males have been known to kill other species. Natives of Papua New Guinea have used the hind legs of a closely related species as fish hooks.

eggs



male (courtesy BMNH, London)



female (courtesy BMNH, London)



male, end of abdomen



female, end of abdomen

Neopromachus sordidus

Dull-spiny Stick-insect

BL: male not known; female 55 mm.

Identification: The female is small, dark brown, and rugged. There are two spines on the back of the head, followed by two in front of the pronotum and two behind. She has three large spines on each side of her mesonotum. The hind part of her metathorax and abdominal segments have a single, central spine, and there are long spines on the sides of segments two to six.

Habitat: This species is known only by two specimens from Thursday Island. Other species in this genus are known to feed on ferns.



female syntypes (courtesy BMNH, London)



female, end of abdomen

Austrocarausius mercurius

Plain Stick-insect

BL: male 63–93 mm, female 91–123 mm.

Identification: The female is grey to dark brown with a heavily, variably granulated body, sometimes with black patches on the first and eighth abdominal segments and elsewhere. The male is greenish-brown and very slender. Both males and females usually have a pair of short spines on the head, which form a tuft in some females.

Habitat: A seldom reported species, it is now known from parts of New South Wales and Queensland in both rainforest and dry eucalypt country. Its food plants include *Eucalyptus* species, palms and many others, even the stinging tree, *Dendrocnide moroides* (Urticaceae). This species can be fairly common in rainforest and has been found at most rainforest locations in northern Queensland. It is unlikely to be seen in the daytime but is often found at night on low-growing vegetation.



male



female and egg (inset)

Austrocarausius nigropunctatus

Black-spotted Stick-insect

BL: male 83 mm, female 108–128 mm.

Identification: The female is grey to dark brown with an irregularly granulated body; the granules are black-tipped. The male is very slender, greenish-brown, with no spines on its head. **Habitat:** Apparently scarce, it was first found on Lizard Island and is only known from a few parts of northern Queensland, such as Bald Hill and Iron Range. Captive specimens will feed on *Eucalyptus*.



male, head and thorax



male, end of abdomen, lateral view



male, end of abdomen, dorsal view



female, head and thorax (courtesy BMNH, London)



eggs



male and female

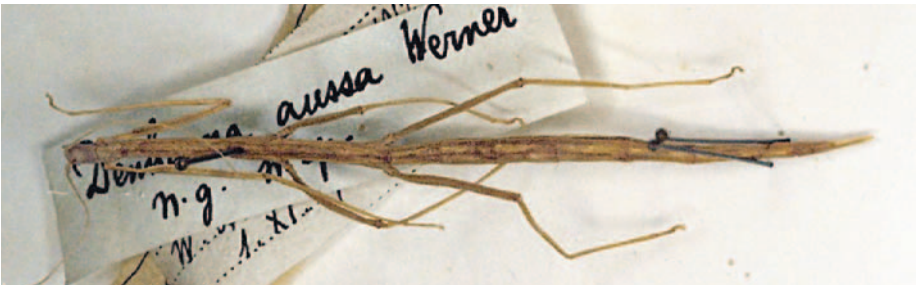
Denhama aussa

Denham Stick-insect

BL: male not known, female 62 mm.

Identification: This is a plain, small, brown species with a hint of a dark central, longitudinal line. The extension at end of its body is longer than its anal segment, and slightly rounded at tip. Its legs are moderately long. It is closely related to both *Denhama gracilis* and *Denhama eutrachelia*,

which appear to be a slenderer species. **Habitat:** The type specimen (which was possibly a nymph) came from Denham, Western Australia. Similar specimens seen in collections from South Australia (Musgrave Ranges and others) may also be the same species. These have slender males (but less elongate than *Denhama eutrachelia*) slightly shorter than females, again with a hint of a darker central line.

*Denhama* sp., mating pair

holotype female (courtesy ZMUH, Hamburg)

Denhama austrocarinata

Australian Ridged Stick-insect

BL: male 72–85 mm, female 100–115 mm.

Identification: An elongate, brown stick insect. The female has a short, truncated extension at the tip of the abdomen. The end of the male's abdomen is triangular in shape and boldly incised. The species is similar to *Denhama striata*.

Habitat: First collected near Derby, the species is distributed in Western Australia and Northern Territory, including near Darwin and Kakadu National Park. It has been collected in numbers fleeing from a bushfire near Darwin. The species has also been reported from northern Queensland, but this is not confirmed.



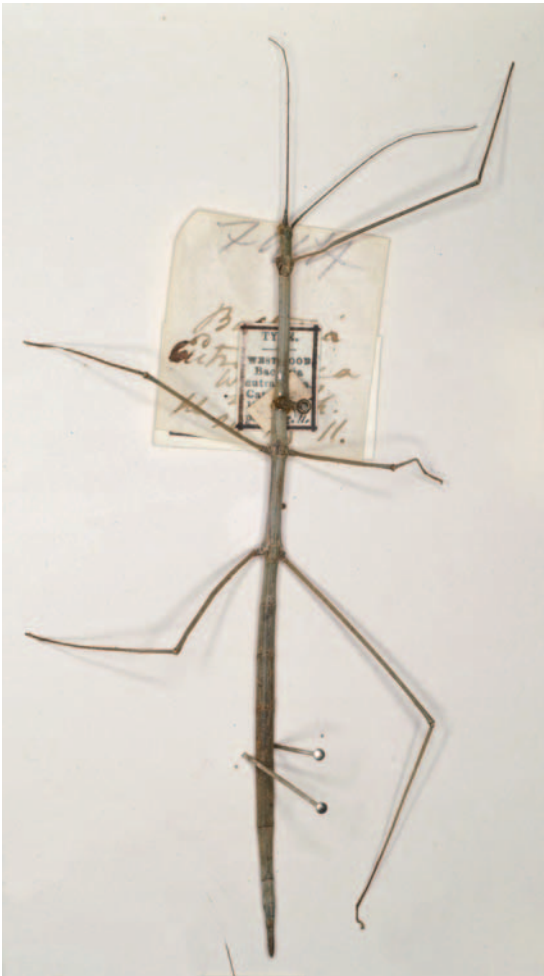
male and female



female nymph

Denhama eutrachelia

WA Thin Stick-insect

BL: male not known, female 90 mm.**Identification:** An elongate, greyish-brown species. The extension at the end of its abdomen tapers to a spear-like tip.**Habitat:** First collected near the Swan River, this Western Australian species has also been collected near Carnarvon and a probable male found in Dongara. *Denhama aussa* may be a synonym.

holotype female (courtesy UMO, Oxford)

Denhama gracilis

Graceful Stick-insect

BL: male 65–75 mm, female 75–90 mm.

Identification: The female is rather plain and slender, with a long extension at the end of its body, slightly rounded at tip. The male is remarkably elongate, with a narrow black longitudinal stripe. The species is similar to *Denhama aussa*. **Habitat:** The species was originally described from a 56 mm female nymph collected at Coleman River, Cape York, in northern Queensland. It appears to be common in drier parts of northern Queensland, feeding on *Acacia*, and also in Northern Territory, including Alice Springs. There is a similar species found in Cooktown, with a distinct, non-striped, more robust-looking male.



male



female



female



egg

Denhama longiceps

Long Denhama Stick-insect

BL: male 90 mm, female 88 mm.

Identification: The male is remarkably thin, with a black longitudinal stripe running the whole length of its body. Although *Hyrtacus imitans* (from the same type locality) is listed as a synonym, it may be a distinct species. There are similar species from other parts of Queensland matched with remarkably elongate females. **Habitat:** The type specimen for this Queensland species was collected at Peak Downs, south-west of Mackay.



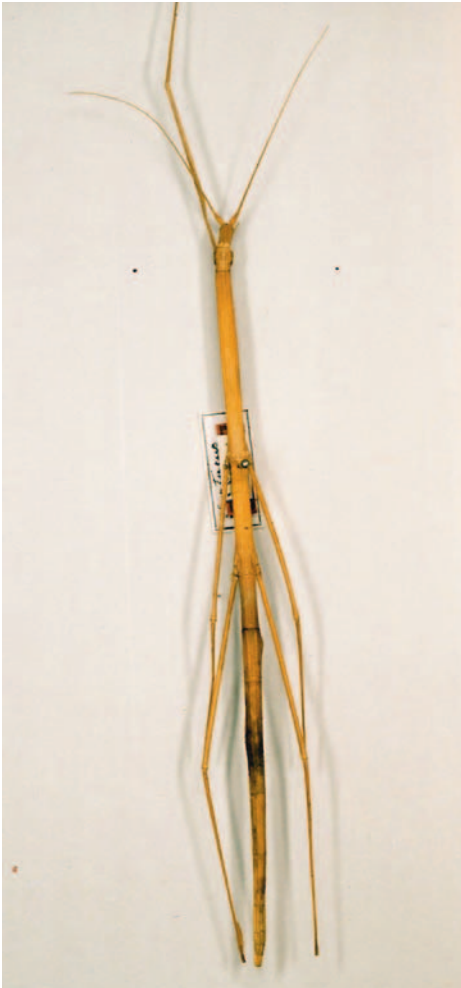
holotype male (courtesy ZMUH, Hamburg)

Denhama striata

Lined Stick-insect

BL: male not known, female 116 mm.

Identification: An elongate, brown stick insect. The female has an extension at the end of her abdomen about as long as the anal segment, which is rounded at tip. This species is very similar to *Denhama austrocarinata*, but appears to be a distinct species. **Habitat:** The type specimen for this Western Australian species was collected at Noonkanbah.



holotype female (courtesy NHRS, Stockholm)



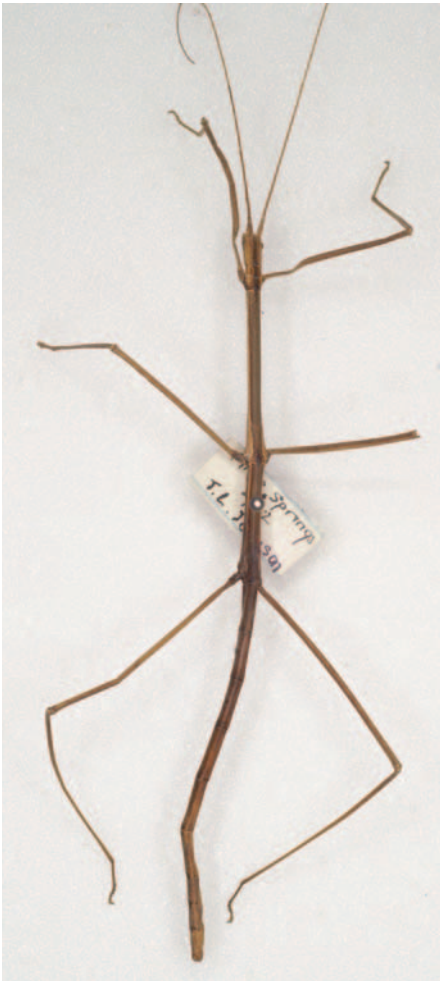
female, end of abdomen

Hyrtacus caurus

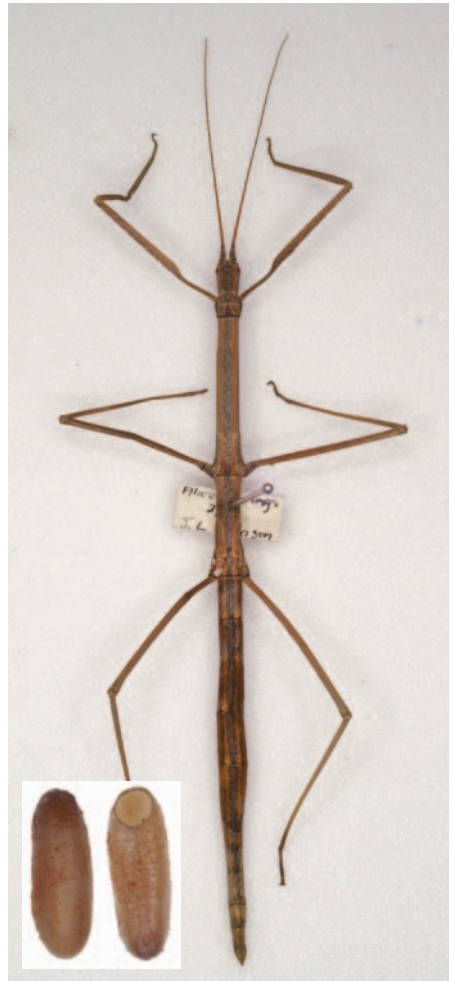
Tepper's Plain Stick-insect

BL: male 53–63 mm, female 73–89 mm.

Identification: This is a plain, stout, brown species, with a faint, narrow, darker, longitudinal central band running the length of its body. **Habitat:** This species appears reasonably widespread in South Australia to Alice Springs, Northern Territory.



male



female and eggs (inset)

Hyrtacus tuberculatus

Lobed-abdomen Stick-insect

BL: male 50 mm, female 60–76 mm.

Identification: This species has double spines between its eyes. Its thorax is granulated and the female also has spine-like tubercles on its thorax. It has abdominal lobes located centrally at the hind part of abdominal segments one to six. **Habitat:** It is fairly widespread in arid parts of Northern Territory (for example, near Alice Springs), South Australia and Western Australia. It has been reported in error from New South Wales and Queensland.



male, female and eggs (inset)

Acanthomima rhipheus

Spiny-thorax Stick-insect

BL: male 50 mm, female 64–72 mm.**Identification:** This small to medium-sized, robust, brown species sometimes has whitish mottling. The number of spines on its mesonotum varies from two to several. It has serrations on all femora, but mostly on its fore femora. Only the female is winged; both fore and hind wings are rudimentary. **Habitat:** There are occasional reports in parts of South Australia (Mitchell, Yeelanna) and Western Australia. The type specimen came from the Swan River. A female collected near Shark Bay was feeding on a *Cassia* sp. (Fabaceae).

male and female



male, head and thorax



male, end of abdomen



female, head and thorax



female, end of abdomen

Acrophylla caprella

Lobe-legged Stick-insect

BL: male 101 mm, female not known.

Identification: This is an elongate, medium-sized, brown, slightly mottled species. It has numerous black-tipped spines and tubercles on its mesonotum. Its wings are whitish-brown. All its tarsi are lobed. **Habitat:** Described from 'Australia' in 1859, this species has not been reported since. We believe this may well be the variable species found in Cape York and Iron Range (male 86–90 mm, female 113 mm), although these Queensland specimens differ in that they have a larger crest on rather shorter mid femora (all their legs are shorter), and there are no lobes on the tarsi. These features may be variable.



holotype male (courtesy UMO, Oxford)



possible female from Cape York

Acrophylla enceladus

Giant Acrophylla Stick-insect

BL: male 140–150 mm, female 175–185 mm.

Identification: This is a beautiful, large species with a heavily spined pronotum and mesonotum. Both male and female have large leaf-like cerci. The hind wings are tessellated brown and white; the pre-anal part is beautifully mottled. *Acrophylla enceladus* could be confused with *Acrophylla titan*, but can be distinguished by its heavily spined thorax and its only slightly serrate femora. **Habitat:** Found in south-east Queensland and north to Cape York, this seldom reported species feeds well on *Eucalyptus*. It has been found in the wild on *Corymbia citriodora* (both Myrtaceae)



male



female and egg (inset)

Acrophylla nubilosa

Cloudy Stick-insect

BL: male 67–91 mm, possible female c. 200 mm.

Identification: This medium-sized to moderately long, brown, slightly mottled species has numerous variably sized (but mainly short) spines and tubercles on its pronotum and mesonotum. The female has black wings while those of the male are tessellated dark brown and white. Its cerci are long and leaf-like. The species is easily recognised by the small size of the elongate males, with their tessellated wings and long cerci, and the numerous variably sized tubercles and spines on its thorax. **Habitat:** Found in Northern Territory (Alice Springs), South Australia and Western Australia, this species seems to be more abundant from September to November. The males are attracted to light and probably feed on *Eucalyptus*.



holotype male (courtesy SAM, Adelaide)



female



male, head and thorax



female, head and thorax



male, end of abdomen



female, end of abdomen

Acrophylla thoon

Quick Stick-insect

BL: male 105–118 mm, female 138–155 mm.

Identification: This moderately long, slender species with a spiny mesonotum is rather variable in colour; the female is grey, green or brown while the male is brown with reddish-brown mesonotum. The male has whitish-brown hind wings; those of the female are black with a beautiful mauve colour on the inner margin of the pre-anal part of the hind wings. Unique in *Acrophylla* species, the female has long, narrow cerci. Slenderer than most species, all the femora of *Acrophylla thoon* are only slightly serrate. **Habitat:** Originally found near Rockhampton, the species feeds on *Eucalyptus* in dry eucalypt forests in northern Queensland. At localities such as the Paluma Range, it can be found on low vegetation. **Note:** Males can fly well; females rely on a startle display, the black hind wings having a bright mauve inner margin. The male produces a spermatophore and will mate regularly. The female lays several hundred eggs, up to about 90 per week. The eggs hatch very quickly after two to three months. The species is easy to rear but the adults are not long-lived; it eats guava in captivity.



male



large male nymph



female and eggs (inset)

Acrophylla titan

Titan Stick-insect

BL: male 135–150 mm, female 200–260 mm.

Identification: This very long stick insect is mottled greyish-brown, with large chequered hind wings. Its mesonotum has bold conical tubercles and its cerci are rather long and ragged. It could be confused with *Acrophylla enceladus*, but *A. titan* has a less spiny thorax and more serrate legs.

It is the only species with long, wavy cerci. **Habitat:** it is found on many food plants in eastern Australia including *Callistemon rigidus* (Myrtaceae) and *Callitris columellaris* (Cupressaceae). During the day specimens may be spotted near the top of small trees in parks and gardens in Brisbane and Sydney suburbs. In captivity it does well on *Acacia*, *Eucalyptus* and *Leptospermum* species, and in Europe it will feed on *Rubus fruticosus*. **Notes:** When disturbed, this species may drop to the ground and walk away rapidly to find suitable cover. Both males and females may flash their wings and hold them open for several seconds. Males are good fliers and the mottled wing pattern forms an excellent camouflage.



male



female and eggs (inset)

Acrophylla wuelfingi

Wülfing's Stick-insect

BL: male 90–149 mm, female 128–233 mm.

Identification: The male is slender and brown with a dark green thorax and plain wings. The female is rather broader, pinkish-brown with various other coloured markings and large, dark brown, sometimes partly tessellated hind wings. Its forewings have a conspicuous whitish patch and the pre-anal part of the hind wings usually have several whitish blotches. The cerci are very short. Nymphs are more often green than brown, the male sometimes having an attractive white longitudinal stripe. This species can be confused with *Acrophylla titan*; however *titan* has long cerci and lacks the whitish band on the forewings. **Habitat:** The species is not uncommon in northern Queensland rainforests, where it feeds on many plants. **Note:** The species has been recorded as a pest of kauri, *Agathis robusta* (Araucariaceae). The behaviour of this species is very much like in *Acrophylla titan*. The male can fly well but mainly downwards. It is an easy species to rear in captivity.



male



female and egg (inset)



large female nymph

Anchiale austrotessulata

Tessellated Stick-insect

BL: male 82–90 mm, female 130–172 mm.

Identification: This is a light to dark brown, sometimes green, winged species, whose wings are sometimes mottled. Its mesonotum has two rows of tubercles and several lateral, black-tipped tubercles, generally more prominently raised in the female, which has shortened, black and white chequered wings. When occurring in large numbers, nymphs may show what is known as ‘high density phase patterns’ – that is they are much darker and more mottled than isolated nymphs. This species is slenderer than other Australian species, and may only be confused with the short-winged *Anchiale briareus*, which however lacks the black-tipped tubercles.

Habitat: It is abundant in the coastal highlands of New South Wales from Kempsey to Gin Gin in south-east Queensland. In some localities it is regarded as a pest. **Note:** The male can fly readily; the female can only glide, at best. She lays up to about 900 eggs, which are dropped to the ground over a period of three to five months and normally hatch in the same year. Sperm can be stored for lengthy periods – in excess of ten weeks. The species can sometimes reproduce parthenogenetically – unfertilised eggs have been known to produce both males and females. Easily reared in captivity, it is a very prolific species. A giant female, 172 mm in length, has been noted from Gin Gin in Queensland.



male and female



male



female and eggs (inset)

Anchiale briareus

Strong Stick-insect

BL: male 80–102 mm, female 123–170 mm.

Identification: This is a medium-sized to large, brown or sometimes green, mottled species, with black and white chequered hind wings, which are reduced in the female (but variable). When reared in large numbers, nymphs also show the high density phase patterns that occur in the closely related pest species, *A. austrotessulata*. Specimens from dry eucalypt forest could be confused with *A. austrotessulata*, but examination of their thorax easily distinguishes them. **Habitat:** This versatile species is abundant in many parts of northern Queensland, feeding on a wide variety of vegetation, often *Acacia* and *Eucalyptus* spp. In rainforest they grow rather larger feeding on *Acacia melanoxylon* (Fabaceae), *Buckinghamia celcissima* (Proteaceae), *Eucalyptus intermedia* and *Syzygium* sp. (both Myrtaceae) and *Litsea leefeana* (Lauraceae); however this species is also at home in dry eucalypt country. At Paluma they are found on low vegetation on *Eucalyptus*, often paired. The females in this habitat are green, shorter, and with smaller wings than those in the rainforest. **Note:** This species is easy to rear in captivity. The females are prolific – each female can lay several hundred eggs.



male



mating pair



female, startle display, and eggs (inset)



female nymph, green colour form)

Anchiale spinicollis

Spiny Anchiale Stick-insect

BL: male 100–120 mm, female 152–166 mm.

Identification: This is a large, robust, greenish-brown species. The female has shortened, black and white chequered wings. Those in the male are whitish with a brown outer margin. This species is easily distinguished by checking its thorax – it is the only *Anchiale* species in Australia which has spine-like tubercles on the pronotum (in the female only). Males of other species have chequered wings. **Habitat:** First recorded from Melville Island, it is distributed in the Northern Territory and is also found in drier parts of northern Queensland, feeding on *Eucalyptus*.



male



female and eggs (inset)

Anophelepis telesphorus

Short-winged Stick-insect

BL: male 73–76 mm, female 77–105 mm.

Identification: This is a yellowish-brown to dark brown species which is rather variable in size. Its fore and hind wings are shortened; the hind wings are black. **Habitat:** First recorded from the Swan River, it is distributed in Western Australia, for example Hamelin Bay and Pemberton. It has been reared in captivity but there is no information on the food plant(s) used.



male and female



female, head and thorax, and eggs (inset)

Arphax australis

Australian Arphax Stick-insect

BL: male 87 mm, female 125 mm.

Identification: This is an attractive brown or green species, with short antennae and a short operculum. The head of the male is whitish with a brown longitudinal central stripe. The female has whitish areas on the sides of her head and above the mid and hind legs. The base of the mid and hind femora is red. **Habitat:** The species is distributed in Western Australia.



male and female

Arphax brunneus

Brown Arphax Stick-insect

BL: male not known, female nymph 73 mm.

Identification: This is a yellowish-brown stick insect with short antennae and whitish tubercles on its thorax. Its metanotum tinged with red. **Habitat:** This Western Australian species is only known from the type specimen collected at the Swan River. If this species is variable, it may be the same species as *Arphax michaelsoni*, in which case the name *brunneus* would take priority.



holotype female (courtesy BMNH, London)

Arphax dolomedes

Crafty Arphax Stick-insect

BL: male 82–91 mm, female 108–116 mm.

Identification: This is a plain, brown or green species. The female has a long operculum. Its pronotum has dark brown blotches. **Habitat:** The species is distributed in Northern Territory and parts of northern Queensland. The synonym *Arphax serrulatus* was described from Adelaide in South Australia, but the locality was almost certainly in error; the female has the same conspicuous markings on the pronotum.



male and female, and egg (inset)

Arphax michaelsoni

Michaelson's Arphax Stick-insect

BL: male not known, female 70 mm.

Identification: This is a brownish species with sparse, spine-like tubercles on its mesonotum. **Habitat:** The species was originally described from South Albany in Western Australia. Research on *Arphax* in this area should reveal whether this species is a synonym of *A. brunneus*, or whether the latter is linked with the normally smooth bodied *Arphax australis*.



female syntype (courtesy ZMUH, Hamburg)

Arphax signatus

Striped Arphax Stick-insect

BL: male 76–91 mm, female 90–145 mm.

Identification: This species is variable in colour. It may be green, light or dark brown, grey or almost black. If plain, its legs may be rather mottled. The female has a long operculum and often has bold white lines on her head, either side of a black central longitudinal band. **Habitat:** Found in parts of northern Queensland, this species feeds on *Brachychiton vitifolius* (Sterculiaceae) and grasses *Triodia microstachya* (Poaceae) in mixed arid *Melaleuca* and *Eucalyptus* forest.



mating pair



mating pair on *Brachychiton vitifolius*



eggs

Cigarrophasma tessellatum

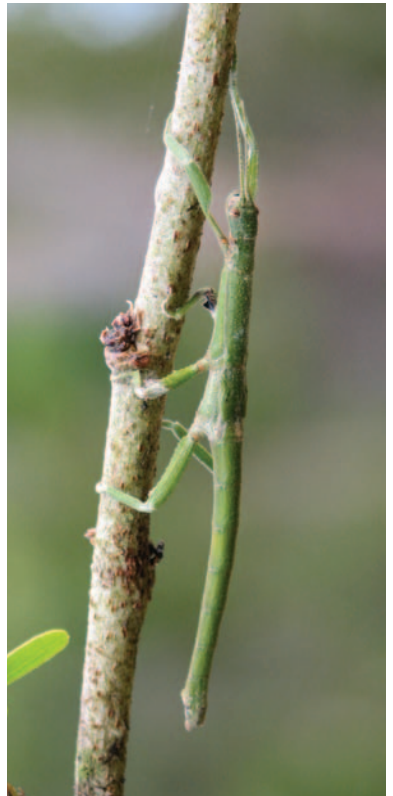
Cigar Stick-insect

BL: male 88–108 mm, female 134–155 mm.

Identification: This attractive species is often grey to brown or sometimes green. It has chequered wings and numerous tubercles on its head and thorax, some on the mesonotum are spiny (male). The broadened legs and abdominal lobes of the female easily distinguish this species. **Habitat:** So far this rainforest-dwelling species has been found only in northern Queensland at Kuranda and at Garradunga, near Innisfail. Those feeding on *Calliandra* range from ashen grey to green; those feeding on *Cardwellia* are purple-brown with deep green streaks. **Note:** The female lays 500 eggs, which hatch in approximately four months. Easy to rear in captivity, insects fed on *Eucalyptus* and *Alphitonia* are brown, and on *Buckinghamia* a beautiful purple. Effective disguise appears to be their main defence strategy; they flash their wings open only as a last resort.



mating pair and eggs (inset)



male nymph

Ctenomorpha gargantua

Gargantuan Stick-insect

BL: male 170–198 mm, female about 300 mm.

Identification: This giant is easily Australia's longest insect, indeed one of the longest insects in the world. It is dark brown with light blotches and a few sparse granulations and tubercles on its thorax. The male has almost full length, dusky-brown hind wings; those of the female are black and rather shortened. **Habitat:** So far this species has been found in rainforest in a small part of north-east Queensland (the Evelyn Tablelands, Garradunga, Kuranda and Mourilyan Harbour) but it is likely to be much more widespread. **Note:** The male can fly well and is attracted to light. When disturbed, the giant female may readily use a startle display.



males



male, head and thorax



newly hatched nymph



female – 615 mm long

Ctenomorpha marginipennis

Margined-winged Stick-insect

BL: male 91–121 mm, female 134–200 mm.

Identification: An elongate, dark brown species of variable size; the female is sometimes dark green. Its thorax has various granulations and tubercles dorsally and laterally. The male has full-length, brown wings; those of the female are rather shorter; her black hind wings having a conspicuous tessellated base. Newly hatched nymphs may be green or brown. **Habitat:** Widespread in heath and woodland in New South Wales, south-east Queensland, South Australia, Tasmania and Victoria. Its food plants include various *Acacia* and *Eucalyptus* (including *E. obliqua*), *Leptospermum* and *Prunus* species. In South Australia it has been recorded feeding on a wide range of plants, some less than a metre tall, including *Daviesia leptophylla* and *Pultenaea daphnoides* (both Fabaceae). **Note:** While a master of camouflage, the female will readily use a startle display, holding her wings open for several seconds. The male flies well and is attracted to lights. This species can be more of a challenge to keep in captivity than other Australian species.



male



female and eggs (inset)



newly hatched nymph (green colour form)

Echetlus peristhenes

WA slender Stick-insect

BL: male 50–56 mm, female 84 mm.

Identification: The female of this slender species is green with a slightly granulated thorax. The male is green, brown or whitish-brown, with a darker brown band between its eyes and back of its head. Its cerci are long – in the female they are almost twice the length of the anal segment, even longer in the male. All femora have a series of black dots. Females have tiny forewings.

Habitat: The species is distributed in Western Australia, for example near Albany.



males and female

Eurycnema goliath

Goliath Stick-insect

BL: male 121–160 mm, female 172–204 mm.

Identification: This large, spectacular species has a yellow head with longitudinal green bands, a green body with some lighter yellowish patches, and a smooth mesonotum or with a variable number of bold bluish-green tubercles. Its underside has a series of four or five pairs of tubercles.

Its transparent hind wings have green veins and a red inner margin. The underside of its forewings and pre-anal part of its hind wings are bright red (or sometimes reddish in the male). The female becomes very plump when egg-laying. **Habitat:** Widespread in coastal New South Wales and south-east Queensland, occasionally found in northern Queensland, and has also been reported from Tasmania. It may be encountered in gardens, parks, bushland and rainforest, usually associated with broad-leaved *Acacia* species, but also *Eucalyptus*. **Note:** This species usually resorts to a startle display when disturbed, exposing the bright red underside of its fore and hind wings. It spreads out its hind legs and can strike repeatedly. This action also displays two false eyes at the base of its hind legs.



male



female showing warning colours



female and eggs (inset)

Eurycnema osiris

Darwin Stick-insect

BL: male 115–136 mm, female 170–255 mm.

Identification: These large, spectacular stick insects have a yellow head with longitudinal green bands, similar to *Eurycnema goliath*, but the male is much more slender with dark green bands. The female has some lighter yellowish patches, while the male has greenish-brown patches. The mesonotum has a variable number of short, stout, often dark-tipped spines. The mesonotum has a pink central longitudinal line with white outer margin, very occasionally bluish-green. The underside has a series of five or six pairs of tubercles, surrounded by bluish-green patches. Its hind wings are transparent, with green veins and a red inner margin, which is purple or reddish and more extensive in the male. The underside of its forewings and the pre-anal part of its hind wings are completely bright red. **Habitat:** This species is more widespread than *Eurycnema goliath*; it occurs throughout Northern Territory, northern Queensland and Western Australia, particularly near coastal areas, associated with *Acacia* and *Eucalyptus* species. It has also been found well inland at Tennant Creek in the Northern Territory. Whilst often high up, adults can be found on saplings. **Note:** Like *Eurycnema goliath*, this species (mainly the female) uses an elaborate startle display as a defence. The female lays several hundred eggs, which usually hatch after about six months at 25°C. The size of the eggs varies from population to population.



female and egg (inset)



female, head and thorax



male



large male nymph



female, startle display



female, startle display showing underside

Hermarchus insignis

Distinguished Stick-insect

BL: male not known, female 155–215 mm.

Identification: The female is large and apple green in colour, with a black ring beneath the eyes. Its broadened mesonotum is sparsely spiny or fairly smooth, and its metanotum has lateral spines. **Habitat:** Described from 'Australia', and known from a synonym from 'Australian Islands', this species was introduced into culture in Europe in the mid 1980s from Queensland and reproduced parthenogenetically, feeding on *Eucalyptus* and *Rubus fruticosus*. It is likely to be localised, perhaps from one or more islands in far north Queensland, and may have been introduced. **Note:** The female lays about 800 eggs and lives about five months.



female and egg (inset)

Onchestus gorgus

Gorgon Stick-insect

BL: male 73 mm, female 88–100 mm.**Identification:** This mid to dark brown species is characterised by its broad appearance. It has short, black and white tessellated wings and a head lacking any protuberances. Both male and female have short wings.**Habitat:** First collected at the Richmond River, this seldom reported species is known from parts of New South Wales and south-east Queensland.**Note:** Males have been reported stridulating in a forest near Lismore, New South Wales. When disturbed, both males and females flash and hold their wings open in an effort to startle a predator.

males



male, head and thorax



female and egg (inset)



female, startle display

Onchestus rentzi

Rentz's Stick Insect

BL: male 82–87 mm, female 102–110 mm.

Identification: This is a mid to dark brown stick insect. The male, which is usually paler than the female, has a pair of spine-like protuberances on its head, which point backwards. The female often has a pair of large tuft-like protuberances on its head (occasionally they are absent) and shortened wings.

Habitat: This species is occasionally found in rainforest in parts of north-east Queensland, often low down on low-growing foliage, and is sometimes seen at rest on the ground or on logs. Its food plants include *Macaranga subdentata* (Euphorbiaceae), *Calliandra tiemorensis* (Mimosaceae), *Psidium guajava*, *Rhodamnia sessiliflora* (Myrtaceae), and raspberry *Rubus idaeus* (Rosaceae). **Note:** When disturbed, both sexes flash and hold their wings open in an effort to startle a predator, and try to walk away quickly.



male and male head (inset)



large female nymph and egg (inset)



female, unusual colour form

Paractenomorpha baehri

Baehr's Stick-insect

BL: male 85–87 mm, female 102–122 mm.

Identification: This medium-sized winged species is rather like the *Ctenomorpha* species but is much smaller. Its mesonotum has numerous granules or tubercles, as well as more conspicuous lobes on the mid and hind legs, and a lobe on the hind part of its fifth abdominal segment.

The female has long cerci while those of the male are rather shorter. The male has whitish wings mottled with brown. **Habitat:** The type specimen (a single female) came from the Gawler Range, South Australia. The species is also known from Maralinga, South Australia and from Emu Field, Western Australia. **Note:** The male is rather like *Acrophylla nubilosa* and this species may become a synonym. Nymphs have been found on *Senna artemisioides coriacea* (Fabaceae) bushes, near Port Augusta, South Australia.



male and female



male and female, head and thorax



male and female, end of abdomen

Paronchestus charon

Spiky-thorax Stick-insect

BL: male 108–111 mm, female not known.

Identification: This is a dark brown species with whitish variegations. It has seven to nine bold, broad spine-like tubercles on its mesonotum. It may be easily recognised by these tubercles. **Habitat:** The species was originally described from Peak Downs, south-west of Mackay, Queensland. A few males only have been collected from near Alpha, Arcadia Valley, Clermont and Taroom. This species appears to be scarce, but is rather conspicuous. Nothing is known about its behaviour, but it is likely to feed on *Acacia*.



male



male, head and thorax



male, end of abdomen

Paronchestus cornutus

Horned Stick-insect

BL: male 98–127 mm, female 200–220 mm.

Identification: This predominantly brown species usually has considerable whitish areas, particularly in females. Its head often has a pair of large horns, which are sometimes absent in females. Its mesonotum is variably spiny; occasionally the spines are absent. **Habitat:** The species was originally described from north-west South Australia, but has been noted from Coober Pedy, Fraser Range and Observatory Hill, and also from Northern Territory and Western Australia. It feeds on *Acacia* and is likely to be quite widespread.



male and eggs (inset)



male, head and thorax



female, head and thorax



male, end of abdomen



female, end of abdomen

Paronchestus pasimachus

Slender-dark Stick-insect

BL: male 110–128 mm, female 159–198 mm.

Identification: This species is brown or grey. The female sometimes has short horns on her head. The mesonotum usually has two spines. **Habitat:** This variable species is likely to be very common. It feeds on *Acacia* and is certainly present in northern Queensland and the Northern Territory. It is found occasionally in New South Wales and south-east Queensland. **Note:** The female holds up to four eggs in her operculum, before releasing them at once.



male



female, head and thorax



female, end of abdomen



eggs

Ramulus stilpnoides

Christmas Island Stick-insect

BL: male 85 mm, female 144 mm.**Identification:** This elongate species is thin and wingless. **Habitat:** It is endemic to Christmas Island and is a typical stick mimic. **Note:** Formerly placed in the subfamily Phasmatinae, this species has now been placed in the subfamily Clitumninae.

male



female



female, head and thorax



eggs

Davidrentzia valida

Rentz's Strong Stick-insect

BL: male not known, female 97 mm.

Identification: This is a robust-looking, medium-sized, mottled, brown species with vestigial wings. Its legs are also mottled brown. A darker longitudinal band stretches the length of its body, although it is less conspicuous on the head and pronotum. **Habitat:** This species is known only from the original type specimen collected in 1988 at Stevens Reserve, near Signal Point, Lord Howe Island. Amazingly, the species was only described in 2007 and is in need of study so that any conservation needs can be identified.



holotype female

Megacrania batesii

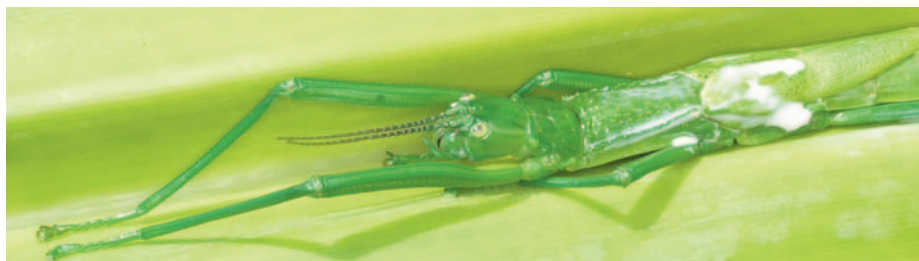
Peppermint Stick-insect

BL: male 72–87 mm, female 101–112 mm (in Australia).**Identification:** This is a beautiful, bluish-green, broad-bodied species with fairly short wings. Nymphs sometimes have reddish antennae.**Habitat:** Originally described from the Solomon Isles, this species is found in New Guinea and the Bismarck Archipelago. In north-east Australia there are

a few coastal populations in mainly mesophyll vine forest from Cape Tribulation to Clump Point, south of Innisfail. They may cause severe damage to *Pandanus* and also *Freycinetia* (both Pandanaceae). **Note:** The insects sit inside the crown of the *Pandanus* protected from predators by the sharp spines of the leaves. If disturbed they usually spray a milky-white, peppermint-smelling secretion from their prothoracic glands at the intruder. They then fold their legs against their body and slide down a groove in the leaf to the centre of the plant. Despite this seemingly excellent defence, they are still preyed on by ants, centipedes, katydids, praying mantids, spiders as well as the black butcher birds. Females lay 60–70 eggs; as they drop some become trapped in the *Pandanus* plant, where they may become very moist. The eggs hatch in about four months. Many host plants overhang the ocean, or creeks and rivers and it is possible that water plays a part in their dispersal. After many years breeding *Megacrania* and observing wild populations south of the Daintree River, researchers have not recorded any males, although they are found in populations from Cape Tribulation.



female



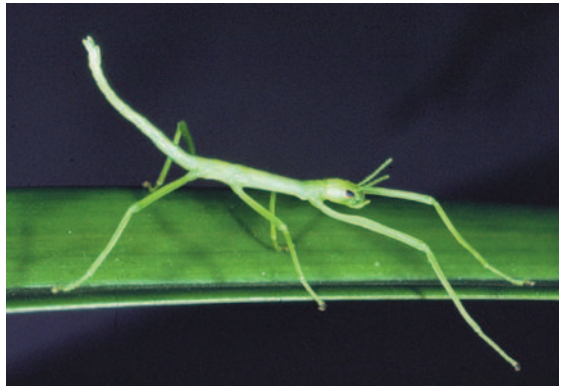
female defensive spray



male and female



damage to *Pandanus* leaves



newly hatched nymph



nymph

Didymuria violescens

Spur-legged Stick-insect

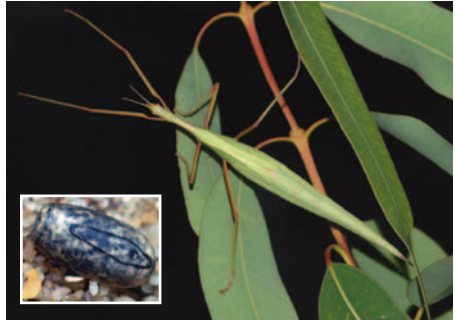
BL: male 66–105 mm, female 75–110 mm.

Identification: The species is very variable in size and colour. The male is brown, sometimes green, with violet or dark brown hind wings; it has three conspicuous larger teeth on its hind femora. The female is green, sometimes brown, and is very plump; her short hind wings may be whitish,

pink-veined or completely pink. **Habitat:** This very widespread species is occasionally a forest pest on *Eucalyptus* species, particularly at higher altitudes. **Note:** Males are capable of limited flight. A spermatophore is produced during mating; the female lays about 200 eggs which typically hatch in November to December. Nymphs take three to four months to mature; adults live two to three months and are mainly seen in late summer. In colder parts, there may be a delay in eggs hatching (diapause) until the next year. When population explosions occur, specimens may be found on walls, parked cars, sometimes at tourist sites such as the Jenolan Caves in the Blue Mountains, New South Wales. Specimens drop to the ground and feign death when disturbed and also emit a secretion from their mouthparts.



male



female and egg (inset)



male, startle display



large male nymph

Didymuria virginea

Cape York Stick-insect

BL: male 89–100 mm, female 89–102 mm.

Identification: The male is elongate, brownish-green, with long, brown hind wings, and even-sized spines on its hind femora. The female is green, elongate but much plumper than the male, and has shortened wings. Males easily distinguished from *Didymuria violescens*, as they lack the large spines on their hind femora. Both males and females have longer wings than *Didymuria violescens*. **Habitat:** Described from Cape York, the species has recently been found at Mt Garnet, northern Queensland, feeding on *Eucalyptus*.



male and female; eggs (inset)

newly hatched nymph

Extatosoma tiaratum tiaratum

Macleay's Spectre

BL: male 75–115 mm, female 100–160 mm.**Identification:** This unmistakable species is a leaf mimic.

The male is slender, brown or sometimes pale green, with large, chequered black/dark brown and whitish wings. The broad-bodied spiny female is variable in size, usually brown, sometimes green (rarely yellow), with rudimentary wings. The legs of both male and female are very spiny and leaf-like.

Habitat: Widespread in parts of New South Wales and south-east Queensland (sometimes in gardens), with populations in rainforest in northern Queensland. Food plants include *Callicoma* (Cunoniaceae), *Caesalpinia sepiaria* (Fabaceae), *Eucalyptus* spp., and *Rosa* sp. (Rosaceae). However, they will accept numerous plants and feed well on *Alphitonia petrei* (Rhamnaceae), *Brachychiton acerifolius* (Sterculiaceae), *Buckinghamia celcissima* (Proteaceae), *Calliandra timorensis* (Mimosaceae), *Psidium guajava* (all Myrtaceae) and *Pipturus argenteus* (Urticaceae).

Note: The species is easy to rear in captivity and is widely kept in worldwide butterfly houses and zoos. Females are occasionally capable of breeding parthenogenetically in the absence of males, but usually lay fewer eggs. Mating is occasionally observed in the daytime, but often takes place at night. The female is heavy (weighing about 20–30 g) and can lay several hundred eggs, sometimes over 1000. Eggs are flicked to the ground (up to about two metres away) and are attractive to ants. They take five to eight months to hatch, although they may remain dormant for up to 19 months. The newly hatched nymphs are remarkably like ants, and can move extremely quickly. However, this stage lasts only a few days – once the nymph starts feeding it slows down and changes colour. By then it could have covered a huge distance, perhaps even reaching the canopy of huge host plants. They have been observed walking on water (contact with water would cause most phasmids to drown), in order to cross a pond. The males moult five times and can live up to five months. The female moults six times and may live well over six months. Defensive behaviour is elaborate and care is needed in handling adult females – they use their spiny hind legs in a pincer action and can cause minor bleeding to fingers. Nymphs and adults can lash out at an intruder, reach out with their forelegs, whether on a branch or if they have fallen to the ground. They also have a habit of curling their abdomen around, scorpion-like, sometimes emitting clicking sounds. A chemical secretion from their mouthparts smells toffee-like. In contrast, adult males can fly away and are capable of gliding some distance, and when settled appear to ‘vanish’. However, the male can also use a startle display, flashing open and beating its wings. Pheromones released by a female sometimes attract several males in the rainforest. Individuals can also emit an extremely fine spray smelling of freshly tanned leather from their prothoracic glands. Formerly placed in the subfamily Tropicoderinae, *Extatosoma tiaratum* has now been placed in the subfamily Extatosomatinae.





males on food plant, *Pipturas argenteus*



female carrying a nymph



eggs showing variety from south-east Queensland (left) and north Queensland (right)



a newly hatched nymph 'walking on water'

Extatosoma tiaratum bufonium

Macleay's Spectre

BL: male c. 100 mm, female 120–130 mm.

Identification: This subspecies is the lichen form of *Extatosoma tiaratum tiaratum*. The female may be distinguished from the leaf mimic form by gaps in the expansions of abdominal segments five to seven. However, the male appears to be identical. This lichen form lays

identical eggs to the leaf mimics. **Habitat:** This lichen form is associated with high altitude and is noted from parts of New South Wales and south-east Queensland, and has also been reported from around Atherton, northern Queensland. There is also an old record from Lord Howe Island. Its range occasionally overlaps with that of the leaf mimic form, such as at Mount Nebo near Brisbane. **Note:** The lichen form is thought to exist as it better matches rainforest areas at higher altitude, where there is a higher species density of ferns, mosses and lichens. Its behaviour is the same as *Extatosoma tiaratum tiaratum*.



female



egg



male

Lysicles hippolytus

Lysicles Stick-insect

BL: BL: male 85–95 mm, female 118–135 mm.

Identification: Although the species was described from a green female, most specimens are probably brown. The female has very short fore and hind wings; the male has short forewings and moderate sized hind wings, both with a broad, pale green margin. There are three large spines on its hind femora. The species is rather less elongate than *Lysicles periphanes*. **Habitat:** The type specimen for this species is from Peak Downs in northern Queensland. Although now missing, it has been matched with a female from near Eulo in Queensland. While females are rare in collections, there are numerous males as they are attracted to lights. The range for this species is believed to extend from New South Wales up to northern Queensland, as well as Northern Territory. A similar undescribed species is found in Western Australia, extending to Alice Springs in the Northern Territory.



male



female



male, end of abdomen



female, head and thorax



female, end of abdomen

Lysicles periphanes

Swan River Stick-insect

BL: male 106 mm, female 84–125 mm.

Identification: This species is much more elongate than *Lysicles hippolytus*; its metanotum is much shorter in proportion and its cerci are longer. The female is grey, green or brown; the male is greyish-brown and lacks the very long spines on hind femora. **Habitat:** Originally collected in the Swan River area, this species is distributed in Western Australia. **Note:** A yellowish pair from Minnie Downs in the far north-east corner of South Australia is less elongate, has dark apices on all femora and may represent a different species.



male



female; end of abdomen (inset)

Malandania pulchra

Beautiful Malanda Stick-insect

BL: male 74 mm, female 92 mm.

Identification: An attractive, robust species. The plump female is a uniform green, with large whitish hind wings. Her head may be boldly banded (with green and white) and her mesonotum has spine-like tubercles, including laterally. The male is greenish-brown; in the few specimens seen the head and the pronotum are brown, while the very spiny mesonotum and legs are green. The forewings have the outer half green, the inner half brown, while the hind wings are a dusky-brown, with the pre-anal part mottled green and brown, with some cream blotches. In both male and female the inner margin of pre-anal part of hind wings is reddish. **Habitat:** First collected from Malanda, this species is known only from a few rainforest localities in northern Queensland, near Cairns, Kuranda and Topaz. Males are good fliers and are attracted to light. When disturbed they actively try to escape and quickly walk away.



male



female



mating pair

Micropodacanthus mouldsi

Moulds's Stick-insect

BL: male not known, female 53 mm.

Identification: The female is small, brown (probably greenish-brown in life) with large whitish wings and a conspicuous black stripe on its mesonotum. The fore and pre-anal part of its hind wings are green. **Habitat:** So far this species is known by only a single specimen from a rainforest near Mossman, a rather understudied area for phasmids. Nothing is known about it.



holotype female (courtesy AMSA, Sydney)

Micropodacanthus sztrakai

Jiva's Stick-insect

BL: male 43 mm, female 66 mm.

Identification: This small, very attractive, leaf-green species has brownish areas over part of its head, pronotum and mesonotum, and at the start of the forewings and tarsi. The male considerably smaller than the female. The hind wings are tessellated deep pink and white, and the base of the pre-anal part is a bright canary yellow.

Habitat: So far it is known by only a mating pair found in January 2007 in dense rainforest by the Barron River, near Kuranda (northern Queensland), a productive area for phasmids. Unfortunately the pair died a few days after being collected. The female had laid several eggs. The host food plants of this species are not known.



male



female



mating pair and eggs (inset)

Parapodacanthus hasenpuschorum

Hasenpusch Family Stick-insect

BL: male 83–93 mm, female 100–119 mm.

Identification: This leaf-green and brown, medium-sized species of glossy appearance has four pairs of large spine-like tubercles on its mesonotum and dark pink hind wings. Newly hatched nymphs are brick red with green leg joints, later changing to yellowish with the first pair of spines on the mesonotum black, followed by a central black longitudinal band, not reaching the end of the mesonotum. **Habitat:** So far it has been found only in rainforest in parts of northern Queensland, where it feeds on *Acronychia acidula*, *Acronychia acronychioides* and *Melicope elleryana* (all Rutaceae). **Note:** Both male and female can fly well. Eggs are orange when laid, and then become dark brown. Nymphs and adults will rapidly walk away from an intruder, quite often leaping from the food plant. When handled, nymphs and adults will grip an intruder tightly with their legs while emitting an unpleasant odour from their prothoracic glands. On several occasions visitors to the rainforest at Garradunga have reluctantly reported seeing ‘fairies with pink wings’ flying overhead between trees – upon capture these ‘fairies’ turned out to be specimens of *Parapodacanthus hasenpuschorum*!



male



female



female with wings exposed; eggs (inset)

Paratropidoderus spinosus

Orange-spined Stick-insect

BL: male 87–101 mm, female not known.**Identification:** This is a medium-sized elongate green species with conspicuous white stripes on its head and mesonotum; it also has a sequence of bold, orange, conical, spine-like tubercles on its mesonotum. **Habitat:** This species

has been collected near Cobar in New South Wales and at

Bundeema, Cunnamulla, Thargomindah and further north to Longreach in Queensland.

Note: Nothing much is known about this colourful species, except that males are attracted to light. It is likely that the female will be large, with broad wings, and a series of tubercles on the mesonotum.

holotype male (courtesy ANIC, Canberra)



male, head and thorax



male, end of abdomen

Podacanthus keyi

Key's Stick-insect

BL: male 83–103 mm, female 91–113 mm.

Identification: This is a medium-sized, almost uniformly light, greenish-brown species, which is slender for the genus. The hind wings of the male are whitish with a pale pink tinge; while those of the female are pink (or at least veins are pink) and with a large, yellowish blotch at the inner margin of the pre-anal part of wings. While superficially similar to *Podacanthus wilkinsoni* in size, this species is easily distinguished by its more elongate appearance. The other known species of *Podacanthus* are rather larger insects, all having a mesonotum which is shorter than that of *Podacanthus keyi*. **Habitat:** Originally described from Floreat Park, Perth, this widespread species is known from various localities in Western Australia. It has also been collected at Serpentine Lakes in South Australia. Its host food plants include *Eucalyptus loxophleba* and *Eucalyptus gomphocephala* (Myrtaceae). **Note:** In captivity, specimens have accepted *Eucalyptus marginata*.



male (courtesy ANIC, Canberra)



female (courtesy ANIC, Canberra); eggs (inset)

Podacanthus typhon

Large Pink-winged Stick-insect

BL: male 80–108 mm, female 110–145 mm.

Identification: The male of this species is brown. The giant, green female has large, pink wings, reaching beyond end of her abdomen. The cerci of both male and female is up to five times the length of anal segment. This species is easily distinguished from other *Podacanthus* species by its large size and much longer cerci. **Habitat:** First 'found on the brushes on the shores of Port Jackson' (now Sydney), this species is associated with dry eucalypt habitat in New South Wales, south-east Queensland and Victoria, feeding on *Eucalyptus*. **Note:** An unfertilised female kept in 1964 laid 428 eggs during a 71 day incubation period. Two unfertilised eggs hatched, indicating an ability to reproduce parthenogenetically. The female has a startle display, said to be less elaborate than *Tropidoderus childrenii*.



male



female and eggs (inset)



female

Podacanthus viridiroseus

Red-winged Stick-insect

BL: male 77–88 mm, female 90–114 mm.

Identification: This is a medium-sized, green species. The male has some brown markings; the female has large, deep-pink wings reaching end of her abdomen. **Habitat:** This *Eucalyptus* feeder is found in New South Wales and Queensland, up to at least Kuranda. It is also found in South Australia and Victoria. **Note:** During 2007 this species was reported in many localities where it had not been noted before. When the species is raised in captivity, it has been shown that all parthenogenetic eggs hatch, while fertilised eggs are slightly harder. The fast-moving nymphs are difficult to rear. If disturbed, this species may open its brightly coloured wings in an effort to startle a predator.



male



mating pair and egg (inset)



newly hatched nymph



female

Podacanthus wilkinsoni

Ringbarker Stick-insect

BL: male 74–90 mm, female 73–93 mm.

Identification: The male is greenish-brown, with two-toned wings; the female is plainer, rather stocky, and has short wings. This species is darker, smaller and stouter than other *Podacanthus* species and is easily recognised by the short wings of the female. In the male, the arched anal segment distinguishes it from the similar *Podacanthus viridiroseus*.

Habitat: Widespread and sometimes abundant in parts of New South Wales and south-east Queensland, this species is regarded as a 'pest', sometimes congregating in their thousands, and feeding on a wide range of *Eucalyptus* species. Alpine Ash (*Eucalyptus delegatensis*) is most severely affected and usually succumbs to complete defoliation. **Note:** This species has a two-year life cycle involving a diapause in the egg stage, although sometimes one year or even three year cycles occur. The female lays about 150 eggs, and parthenogenetic reproduction is possible. Nymphs typically hatch in August and September but may be later in adverse conditions, maturing in December to January, dying in March to April. Parasites of the species include the bright red mite, *Callidosoma froggatti*, and various wasps.



male



female and eggs (inset)

Tropidoderus childrenii

Children's Stick-insect

BL: male 110–124 mm, female 105–142 mm.

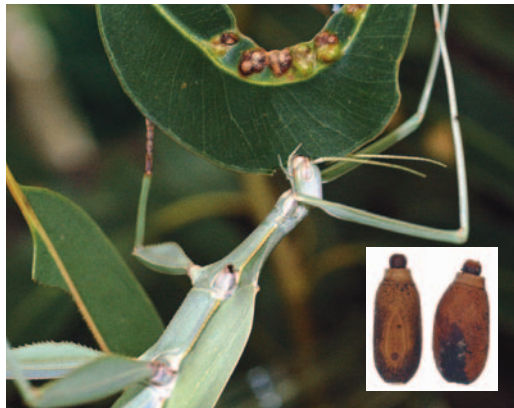
Identification: This is a large, pale green species with a rather broadened mesonotum, mid and hind femora. The female has a bright, bluish-mauve inner margin on its hind wings. **Habitat:** The most common *Tropidoderus* species, this *Eucalyptus* feeder is widely distributed in New South Wales, south-east Queensland (and possibly much further north), South Australia and Victoria. **Note:** This species is easy to rear. The female drops 450 or more eggs to the ground over about three months. Fertilised eggs hatch after several months; some may hatch parthenogenetically. The female has a startle display, beating her fore and hind wings rapidly in a fluttering motion, revealing the bright, bluish-mauve warning colours. While moving her body about, she stands her ground and does not attempt to escape, and may strike out with her legs. However, the insect is capable of a gliding, downwards flight.



male



female



female and eggs (inset)

Tropidoderus gracilifemur

Sjöstedt's Graceful Stick-insect

BL: male 95–122 mm, female 108–142 mm.

Identification: The male of this species is green or brown and elongate. The female is green and less broad-bodied than other *Tropidoderus* species. The inner margin of pre-anal part of her hind wings is red. This species is easily distinguished from other *Tropidoderus* species by the slenderer females, with only slightly broadened femora. **Habitat:** This *Eucalyptus* feeder

is distributed across Northern Territory, northern Queensland and Western Australia, sometimes in coastal localities (such as Cairns) but mainly well inland. It is occasionally found at the Ethabuka Reserve, near Bedourie, Queensland, which is at the northern end of the Simpson Desert on the Queensland/Northern Territory border.



male



female and eggs (inset)

Tropidoderus michaelseni

Michaelsen's Stick-insect

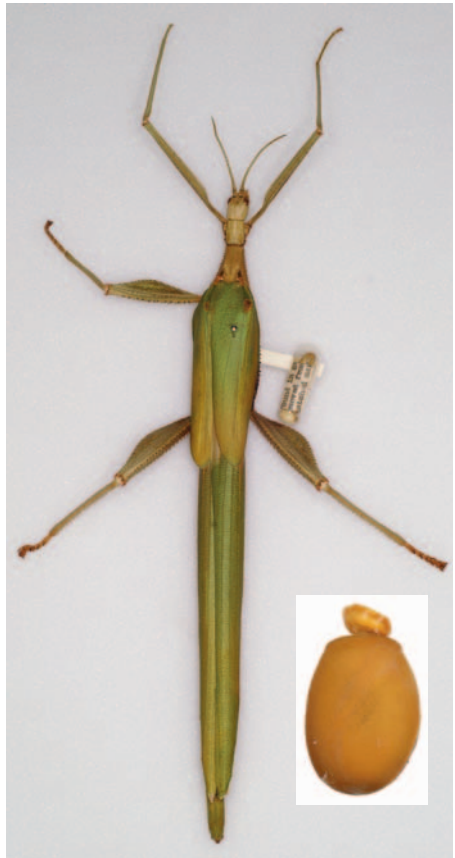
BL: male 111–125 mm, female 164–169 mm.

Identification: The male of this species is brownish-green, elongate, and has large tessellated wings and large cerci. The female is huge, leaf green and broad-bodied. The inner margin of the pre-anal part of its hind wings is red. This species is closely related to *Tropidoderus rhodomus*, possibly a synonym, but its eggs are slightly different, along with other minor features.

Habitat: Described from a giant female from Subiaco North, Perth, Western Australia, this species presumably feeds on *Eucalyptus*.



male



female and egg (inset)

Tropidoderus prasina

Green Stick-insect

BL: male 95 mm, female 107–109 mm.

Identification: This is a medium-sized, plain, green or brown species. The inner margin of the pre-anal part of its hind wings is deep blue. **Habitat:** It was described from Atherton, northern Queensland. **Note:** It is closely related to *Tropidoderus childrenii* and, although rather smaller, it may be a synonym. However, the eggs of a female from Irvinebank collected in 2007 indicate it may be a distinct species. This female changed colour depending on its surroundings, from brown to pink and darker when the container had a blue lid. The only other species known from northern Queensland is the slenderer *Tropidoderus gracilifemur*.



female, startle display, and eggs (inset)

Tropidoderus rhodomus

Red-shouldered Stick-insect

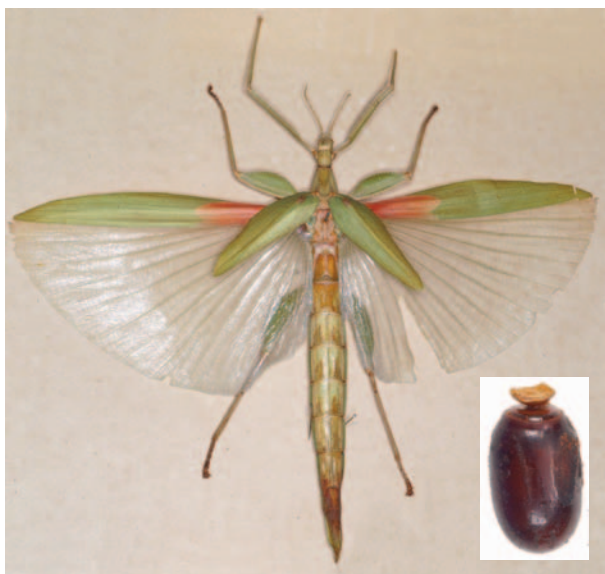
BL: male 83–115 mm, female 107–150 mm.

Identification: The male of this species is brown, elongate, with large tessellated wings and moderately large cerci. The female is green or brown, large and broad-bodied. The inner margin of the pre-anal part of her hind wings has a bold red patch, while the underside is completely red.

It is related to *Tropidoderus michaelseni* and is possibly the same species. **Habitat:** This stunning large species was described from Inglewood in Victoria. It feeds on *Eucalyptus* and has also been reported in parts of New South Wales, South Australia (Eyre Peninsula, Fraser Range and Hambridge National Park), northern parts of Victoria and Western Australia. There is also a record from Rockhampton, Queensland, which, if correct, means that this species may be even more widespread. **Note:** The size of the female is usually within the range 137–150 mm, although a miniature 107 mm female has been found, which laid 58 eggs in 11 days.



male



female and egg (inset)

Xeroderus kirbii

Kirby's Stick-insect

BL: male 60–70 mm, female 85–97 mm.

Identification: This uncommon species is unmistakable due to the lateral lobes on its abdominal segments. Its body and legs are mottled white, black and brown. Its hind wings are greyish-brown with a reddish inner margin. **Habitat:** It occurs occasionally in rainforest, both coastal and inland, in northern Queensland, from Rockhampton to north of Cooktown. It has also been noted from Coolum, Fraser Island, and Gin Gin, south-east Queensland, in *Melaleuca* forest on mossy rock. **Note:** Remarkably camouflaged on tree trunks and rocks, it uses a startle display, opening its vividly coloured wings. It has been seen folding its forewings and revealing the underside, possibly to better match its surroundings, or to surprise a possible predator.



male



male, head and thorax



female

Chitoniscus lobiventris

Lobed Leaf-insect

BL: male 35–38 mm, female 60–62 mm.**Identification:** This is a small, plump, green leaf-like species with lobes on abdominal segments six to eight. **Habitat:**

The species was described from Fiji and is also found in the Solomon Islands. There is only a single record from Australia – a female from Cairns, northern Queensland, in 1903.

Note: Sailors are known to have sold leaf insects as curiosities and it is possible that this is how this species was reported from Australia. While this record could be an error, this species may be resident in Australia but, like other leaf insects, it is rarely encountered.

female

Nanophyllium pygmaeum

Pygmy Leaf-insect

BL: male 28–30 mm, female not known.

Identification: The male is very small, dark brown and leaf-like, with short forewings. Its hind wings are dark brown. All its femora have exaggerated lobes. Its abdomen is narrow, tapering sharply towards the tip. **Habitat:** The type specimen is from Katau in the Gulf of Papua region of New Guinea, close to the north-east Australian coast. The species is likely to be extremely rare in Australia, although a male nymph was found in 1986 near Mt. Tozer, near Iron Range National Park, northern Queensland, and a possible female nymph was found in 1971. **Note:** The male nymph collected in 1986 accepted *Pyracantha* (Rosaceae) leaves in captivity. The female adult is not known but may be similar to *Phyllium* (*Phyllium*) *siccifolium*.



large male nymph



male

Phyllium (Phyllium) monteithi

Monteith's Leaf-insect

BL: male 56–64 mm, female 75–76 mm.

Identification: This is a classic leaf-shaped insect with broadened, leaf-like legs. The male is green with long forewings and transparent hind wings. The female is much broader with large forewings covering most of her abdomen. Newly hatched nymphs are very dark brown, almost black, with red patches of their legs, but turn reddish-brown after feeding and, later, to green. **Habitat:** This species is known only from few records from various parts of a 140 km stretch in northern Queensland between Mossman and Innisfail, including rainforest locations up to 40 km inland. In the wild, it is believed to feed on *Cryptocarya mackinnoniana* (Lauraceae) in the rainforest canopy. **Note:** A true master of camouflage, it may seem to completely disappear on its food plant. Even the nymphs may resemble chewed or mouldy and dead leaves. Males are attracted to light. They readily fly and emit an unpleasant-smelling fluid from their mouthparts when handled.



male



male



large male nymph



drawing of female; egg (inset)

Appendix 1: Keys to genera and species

Subfamily Necrosiinae

A large group of about 620 mainly South-East Asian species (a few New Guinean). The Australian representatives are often winged, elongate, mainly small to medium-sized phasmids with long antennae. The Asian fauna includes many with more colourful wings than in Australian species.

Key to genera

	Genus	Body, including key features	Hind wings	End of anal segment
1a Winged in both sexes, smooth or granulated thorax.				
	<i>Austrosipyloidea</i>	More elongate than most other Necrosiinae, black longitudinal stripe running length of body; abdomen in female with several large black blotches; cerci remarkably long.	Whitish, with bold yellow basal area.	Subtruncate; usually incised in centre.
	<i>Mesaner</i>	Broader in female. Dark with a black central line running length of the body. Cerci long.	Brown, darker towards outer margin.	Triangular incised in male, rounded in female.
	<i>Scionecra</i>	Elongate. Legs short to moderately long.	Brown.	Subtruncate.
	<i>Sipyloidea</i>	Slender, often fairly plain. Thorax may be smooth or granulated (rarely with tubercles). Legs long. Cerci variable.	Various: brown, white, yellow.	Variable, often subtruncate, may be incised.
1b Winged in both sexes, tubercles or spines on thorax (mesonotum)				
	<i>Malandella</i>	Upper half of mesonotum with 4-6 conspicuous orange spines, often black-tipped.	Whitish.	Triangular incised in male (hardly in female).
	<i>Rhamphosipyloidea</i>	Sparse short tubercles or large cone-like tubercles on mesonotum.	Whitish-brown.	Beak-like in female.
	<i>Spinosipyloidea</i>	Spiny (female) or tuberculate (male) mesonotum.	Whitish and black tessellated in female; whitish in male.	Rounded at tip (female), two-lobed (male), both deeply incised in centre.
1c Wingless (or wing rudiments only) or winged in only one sex.				
	<i>Candovia</i>	Often plain, sometimes legs banded. Thorax smooth or granulated; tubercles occasionally present. Cerci variable.	n/a	Variable.
	<i>Cornicandovia</i>	Small, the only genus with a double-horned head	n/a	Rounded, centre incised.
	<i>Leprocaulinus</i>	Elongate, medium to large size; body heavily granulated, crest or pair of spines between eyes. Cerci very short.	Whitish (male); female wingless or with wing rudiments.	Truncate, slightly rounded, may be incised.

***Austrosipyloidea* Brock & Hasenpusch**

World: 1 species. Australia: 1 species.

Characteristics: Elongate medium-sized winged phasmids, body length c. 75 mm in males, 110 mm in females. Body smooth, pale, with a bold longitudinal black stripe running the length of the body in type species, fainter on the abdomen. Head slightly longer than wide. Pronotum same length as head or slightly longer. Mesonotum elongate, $4-5 \times$ length of pronotum. Metanotum and medium segment slightly shorter. Antennae long, easily exceeding length of forelegs. Forewings short, hind wings reasonably long, not reaching end of 5th or 6th abdominal segment. Legs unarmed, moderately long, hind legs short of anal segment, particular in females. Operculum curved sharply to slightly rounded tip, not reaching end of 9th abdominal segment. Male subgenital plate similar length, end broader, subtruncate. Cerci remarkably long, narrow double pronged structure, over twice length of elongate anal segment. **Egg:** Smooth oval capsule, with dome-shaped operculum. Micropylar plate broad, almost running the full length of the dorsal surface. **Note:** No other known Australian (or world) Necrosiinae have the double pronged, fragile long cerci characteristic of this genus, which is close to *Sipyloidea*.

***Candovia* Stål**

World: 10 species. Australia: 10 species.

Characteristics: Small to medium-sized, rather plain, wingless insects, smooth or granulated; tubercles occasionally present. Rather like *Sipyloidea* without wings, and often less elongate. Cerci short to long. Sometimes with colourful markings on head, body and/or banding on legs. The legs are variable in length, mid legs may be short or elongate. **Egg:** Small, almost oval, heavily sculptured and rugged capsule, broad central micropylar plate. Operculum flat, except for short capitulum. **Note:** Until 2007, *Candovia* Stål, 1875 was synonymised with *Hyracus* Stål, 1875, but the type species *C. coenosa* belongs to this group, formerly placed in *Parasipyloidea* Redtenbacher, 1908. It includes species with short and moderately long cerci, which has caused confusion with other genera, particularly *Echetlus* Stål, 1875 (Phasmatidae: Platycraninae), which has shorter antennae and is not closely related. Further research is needed on *C. pallida* and *C. peridromes* which may belong to another genus, also *C. evoneobertii*. **Distribution:** Australia, South America including Brazil (believed to be introduced) and Paraguay. There are several species yet to be described.

Key to *Candovia* species

Species	Body	Key features	Legs
<i>C. aberrata</i>	Elongate in both sexes, greenish-brown male. Hind part of abdomen with small black central blotches in both sexes.	Male head with bold 'V' shaped black pattern between eyes; pronotum with three black lines; also black abdominal blotches.	Plain.
<i>C. annulata</i>	Elongate in both sexes, male dark brown or black, whitish bands on head, mesonotum and metanotum; female plainer brown, mesonotum with several tubercles laterally.	Legs; in female, tubercles.	Femora with subapical whitish band; tibiae inconspicuously banded (in female fainter).
<i>C. coenosa</i>	Elongate in both sexes; thorax granulated.	Granulated thorax; long mid legs.	Slightly mottled; mid legs long.
<i>C. evoneobertii</i> *	Elongate (only female known), smooth but body may have lighter flecks.	Long cerci.	Plain.
<i>C. granulosa</i>	Stocky, abdomen with various ridges.	Stocky body.	Plain.
<i>C. pallida</i>	Elongate in both sexes, extremely so in female.	Long cerci (in male slightly longer than anal segment); mesonotum 5.5–6 × length of pronotum; thorax with broken black lateral stripe.	Plain.
<i>C. peridromes</i>	Elongate in both sexes.	Long cerci (in male two-thirds length of anal segment); mesonotum usually about 4.5 × length of pronotum.	Plain.
<i>C. robinsoni</i>	Small, male elongate brown with darker flecks, female plump, usually dark green, but can be darker; mouthparts orange. Abdomen ridged.	Small size, body form.	Plain.
<i>C. spurcata</i>	Elongate, mesonotum with conspicuous tubercles.	Tubercles.	Femora and tibiae inconspicuously mottled.
<i>C. strumosa</i>	Elongate, various colour forms in female from green to grey, brown and almost black; mesonotum in female usually with sparse tubercles. Male has black mark between eyes, on pronotum and possibly also on hind part of abdominal segments.	Tubercles; end of 6th abdominal segment in female swollen and raised, usually darker (often black); short mid legs.	Femora and tibiae slightly mottled.

* Note: Similar to *C. peridromes*, but egg differs – may only be found in South America.

Cornicandovia Hasenpusch & Brock

World: 1 species. Australia: 1 species.

Characteristics: Elongate, small, green, wingless phasmid, body length c. 56 mm in female (male not yet known). Body mainly smooth, key feature is the double-horned head. Head slightly longer than wide, at posterior armed with two large conical horns, pointing forwards. Pronotum smooth, same length as head. Mesonotum sparsely and irregularly granulated, $4 \times$ length of pronotum. Metanotum considerably shorter. Antennae long, probably exceeding length of forelegs (tip of antenna broken). Legs unarmed, moderately long, hind legs short of anal segment. Abdomen with carina present. The 8th abdominal segment half the length of 7th; 9th considerably shorter than 8th, but about same length as anal segment, whose tip is rounded, incised in centre. Operculum long, carina present, tapered to rounded tip, reaching end of 9th abdominal segment. Cerci short, fairly broad, tapering to rounded tip. **Egg:** Not known. **Note:** No other known member of the Necrosciinae has the double-horned head.

Leprocaulinus Uvarov

World: 4 species. Australia: 1 species.

Characteristics: Medium to large, body moderately or extremely elongate and wholly granulated. Head with a pair of elevated transverse crest or spines between small eyes. Antennae long, just exceeding end of forelegs (male), or a little shorter (female); basal segment very broadened and flattened. Pronotum about same size as head. Mesonotum more than $6 \times$ length of pronotum; mesosternum with distinct median carina. Metanotum up to almost $3 \times$ shorter than mesonotum. Female forewings absent or rudimentary (hind wings absent), males with moderate length hind wings; reaching up to about end of 4th abdominal segment. Operculum broad, boat-shaped, round at apex, reaching end of anal segment, which is truncate or incised. Subgenital plate in male slightly rounded and incised at tip, almost reaching end of 9th abdominal segment. Cerci short, hidden beneath abdomen. Legs elongate, hind legs exceeding end of abdomen in male, but not female. Fore tibiae very broadened, also tarsi with lobe or crest; end of mid and hind tibiae broadened.

Distribution: Australasia, Indonesia.

Malandella Sjöstedt

World: 1 species. Australia: 1 species.

Characteristics: Small, elongate; head longer than wide; eyes small. Antennae long, easily exceeding forelegs. Pronotum shorter than head. Thorax with sparse granules, particularly towards hind part, also laterally. Mesonotum up to $4 \times$ length of pronotum, with four to six spines on upper half. Metanotum shorter than mesonotum. Forewings short, subtruncate at tip; hind wings moderately long. End of abdomen triangular incised in male (hardly in female), subgenital plate not reaching end of 9th abdominal segment; cerci short but broad, narrow at tip. Female operculum tapered to slightly rounded, narrow tip. Legs elongate; hind legs in male easily exceeding end of abdomen, but not in female. **Egg:** Small, oval, heavily sculptured capsule, including broad operculum. Micropylar plate oval, central, median line usually above this, reaching rim.

***Mesaner* Redtenbacher**

World: 1 species. Australia: 1 species.

Characteristics: Medium-sized; robust appearance with longitudinal line running length of body; head about as long as wide; eyes small. Antennae long, considerably exceeding forelegs. Pronotum slightly longer than head. Thorax sparsely granulated. Mesonotum fairly short in females, just over $2 \times$ length of pronotum; up to $3 \times$ in male. Metanotum shorter than mesonotum. Forewings short, slightly rounded; hind wings moderately long, shorter in male, not reaching beyond end of 5th abdominal segment. End of abdomen slightly triangularly incised in male, tip of subgenital plate rounded, exceeding end of 9th abdominal segment. End of abdomen in female rounded; operculum tapered to tip. Cerci longer than anal segment, like a narrow leaf. Legs moderately long, but hind legs not quite reaching end of abdomen in male, shorter in female. **Egg:** Oval, glossy, black, usually with hint of bluish-green or mauve. Micropylar plate a long, broad band from base to opercular rim.

***Rhamphosipyloidea* Redtenbacher**

World: 8 species. Australia: 2 species.

Characteristics: Same as *Sipyloidea*, i.e. slender, small to medium-sized, winged species, body smooth or granulated (rarely with large tubercles), legs elongate, plain. Initially placed in a subgenus of *Sipyloidea*, differentiated only by the long, pointed anal segment. **Egg:** Capsule long and thin, variably sculptured, with bold, darker, micropylar plate on lower half, with a marked central ridge. Operculum flat. **Distribution:** Australia, South-East Asia.

Key to *Rhamphosipyloidea* species (females)

Species	Body, including colour	Mesonotum	Hind wings
<i>R. palumensis</i>	Slender, brown; mottled with darker flecks and lines; femora and tibiae faintly banded. Head with faint black central longitudinal line.	Sparsely granulated, dorsally, laterally and on the paler ventral surface. Also with five almost paired but well spaced tubercles, dorsally.	Whitish-brown, reaching just over end of 3rd abdominal segment; pre-anal part mottled brown.
<i>R. queenslandica</i>	More robust, brown; mottled with lighter flecks and lines (green or whitish); femora and tibiae conspicuously banded brown/black and whitish. Head with bold black central longitudinal line.	With 7–10 large conical spine-like tubercles (in male replaced by normal tubercles).	Whitish-brown, reaching almost half the length of 5th abdominal segment; pre-anal part mottled greenish and brown.

Scionecra Karny

World: 23 species. Australia: 2 species.

Characteristics: Similar to *Sipyloidea*, i.e. slender, small to medium-sized, winged species (but more elongate), body smooth or granulated, legs often elongate, plain, rather shorter than most Necrosciinae. Genus described by Karny to accommodate selected *Aruanoidea* of Redtenbacher, 1908 (*Aruanoidea* has since been listed as a synonym of *Necrosia*), differentiated only by the shorter forewings, rounded in middle, and brownish hind wings.

Egg: Oval, heavily sculptured or plain capsule, net-like (including operculum), broad micropylar plate almost from base to rim; broader at base. Operculum flat. **Distribution:** Australia, South-East Asia. **Note:** *S. queenslandica* and *S. milledgei* may not be correctly placed in *Scionecra*; a study of eggs may assist, if any become known from Asian members of the genus.

Key to *Scionecra* species

Species	Head	Hind legs
<i>S. milledgei</i>	Light brown, two black longitudinal lines.	Moderately long, in male exceeding end of abdomen, in female almost reaching end of 7th abdominal segment.
<i>S. queenslandica</i>	Dark brown.	Short, in male about reaching end of abdomen, in female only reaching end of 5th abdominal segment.

Sipyloidea Brunner

World: 67 species. Australia: 11 species.

Characteristics: Small to medium-sized, elongate, large-winged species. Head elongate and depressed. Antennae long, often exceeding end of forelegs in both sexes. Mesonotum smooth, granulated or with tubercles. End of operculum pointed or round, often reaching end of anal segment (variably incised or subtruncate). Subgenital plate in male variable. Legs elongate, unarmed; base of fore femora incurved. **Distribution:** Australasia, Asia.

Key to *Sipyloidea* species

	Species (body colour)	Head	Thorax granulations	Hind wings	Cerci
1a	Colourful greyish-green insects, with pink wings, tiny in the female = <i>S. nelida</i> group.				
	<i>S. bella</i>	-	-	Micropteris in female.	Short; robust (male), slender (female).
	<i>S. nelida</i>	-	-	Micropteris in female.	Elongate, slender.
	<i>S. similis</i>	-	-	Micropteris in female.	Short, robust.

Note: There are also further undescribed representatives of the *S. nelida* group in New South Wales, Queensland and Western Australia.

Key to *Sipylodea* species (contd.)

1b Both sexes winged, shortened in some females, but not micropterus.				
<i>S. brevicerci</i> (dark brown, indistinctly mottled)	Bold central line and faint lines either side of eyes (brown with one black stripe); no spots present between eyes.	Mesonotum conspicuously, but sparsely granulated.	Long, dusky brown.	Short in both sexes (female 0.5 mm), hardly visible beyond end of abdomen.
Note: Very closely related/similar to <i>S. larryi</i> , but legs are shorter than body length. Eggs also differ				
<i>S. caeca</i> (brown, mottled)	Bold, black, central line and faint lines either side of plain brown eyes; no spots present between eyes.	Mesonotum conspicuously, but sparsely granulated.	Long, whitish-brown.	Moderately long (female 1.4 mm) and slender.
Note: A slenderer, smaller species in both sexes compared with similar mottled brown spp; legs shorter and eggs are very distinctly indented.				
<i>S. garradungensis</i> (green)	Faint central line. Eyes dark brown; no spots present between eyes.	Mesonotum inconspicuously granulated.	Shortened in female in particular, yellow.	Moderately long (female 1.5 mm) and slender.
<i>S. gracilipes</i> (usually light brown, sometimes mid-brown; more elongate than other spp.)	Bold, black, central and lateral lines may be present; eyes brown; no spots present between eyes.	Mesonotum sparsely granulated.	Long in male, whitish, rather shorter in female.	Fairly short (female 0.8 mm).
<i>S. larryi</i> (brown, mottled or plain)	Bold, central line and bands either side of eyes (brown with 1–2 black stripes); usually with 3 black spots between eyes, unless heavily mottled.	Mesonotum conspicuously granulated.	Long, dusky brown.	Moderately long (female 1.5 mm), stout.
Note: Very closely related/similar to <i>S. brevicerci</i> , but legs longer than body length; eggs also differ.				
<i>S. lewisensis</i> (brown, mottled)	Dark, central and outer bands/lines before eyes (brown with one black stripe); no spots present between eyes.	Mesonotum conspicuously granulated, also with tubercles (unlike other species, comment also applies to head and pronotum).	Long in male, whitish-brown, rather shorter in female.	Short (female 0.8 mm), longer in male.
<i>S. rentzi</i> (green)	Pale, lateral band by brown eyes; no spots present between eyes.	Mesonotum sparsely granulated.	Long, whitish with a hint of yellow.	Long (female 3.5 mm) and slender.
<i>S. whitei</i> (dark brown/ black)	Bold black central and lateral lines; eyes brown with two narrow black stripes; no spots present between eyes.	Mesonotum sparsely granulated.	Long in male, whitish-brown, rather shorter in female.	Fairly short (female 0.8 mm).

Spinosipyloidea Hasenpusch & Brock

World: 1 species. Australia: 1 species.

Characteristics: Stocky, small to medium-sized, winged phasmids. Head almost as wide as long, eyes small. Bold central longitudinal stripe, with dark brown central patches between eyes and stripe. Antennae with c. 80 indistinct segments, longer than forelegs; first two segments slightly broader. Bold central longitudinal stripe continuing along thorax. Pronotum slightly longer than head. Mesonotum twice length of pronotum, with a cluster of bold, paired spines, particularly slanting forwards (female), or tubercles (male). Laterally with several short spines, ventrally with a series of central tubercles. Metanotum almost as long as mesonotum. Forewings large, subtruncate at tip. Hind wings large, reaching up to end of 9th abdominal segment; tessellated in female. Anal segment in female much shorter than 9th abdominal segment rounded at tip, deeply incised in centre. Two deep ridges either side of centre; operculum long, pointed at tip, almost reaching end of anal segment. Anal segment in male broad, with two rounded lobes and bold ridges. Cerci short, rounded at tip. Legs banded, rather short for Necrosciinae; apex of fore femora slightly broader. All femora with short apical spines. **Egg:** Oval capsule, extremely hairy, hence small, almost central micropylar plate, partly obscured. The unusual eggs can stick to surfaces. **Note:** Spines are rare in Australian Necrosciinae, with the slender *Malandella queenslandica* possessing a few mesothoracic spines. While one *Rhamphosipyloidea* species has more thoracic spines (female only), it is an elongate insect, with a beak-like abdomen. The stocky *Spinosipyloidea doddi* is easily distinguished (the tessellated female hind wings are also unique so far in Australian Necrosciinae) and appears to have no close Asian relatives. The egg of this genus is unusual and appears to be designed to stick to surfaces; this may be an adaptation to the host food plant, whose leaves are hairy, hence eggs cling to them.

Subfamily Pachymorphinae

A large subfamily of about 210, usually small, African, European, Middle Eastern, Asian wingless species, either remarkably slender with short antennae, or rather stouter-bodied. The few Australian and New Zealand species are rather understudied, stout-bodied insects, all belonging to the tribe Pachymorphini.

Key to genera

Genus	Characteristics
<i>Acanthoderus</i>	Medium-sized; elongate (but stout in female), mesothorax some $5 \times$ length of pronotum, very spiny from pronotum to 3rd or 4th abdominal segment.
<i>Pachymorpha</i>	Small and stocky, mesothorax $3.5\text{--}4 \times$ length of pronotum, tubercles present on body, sometimes spines to 1st abdominal segment.

***Acanthoderus* Gray**

World: 1 species. Australia: 1 species.

Characteristics: Stocky, medium-sized wingless phasmids, although glossy male rather elongate; very spiny from pronotum to 3rd or 4th abdominal segment. Head longer than wide, eyes small. Bold, central longitudinal stripe in female, with central patches between eyes and stripe. Antennae short, half the length of fore femora in female, not reaching end of fore femora in male. Pronotum about same size as head. Mesonotum 5 × length of pronotum. Metanotum about two-thirds length of mesonotum. Operculum long, rounded at tip, reaching end of 9th abdominal segment. Anal segment in male truncate at tip; subgenital plate reaching half the length of 9th abdominal segment. Cerci short. Mid and hind legs spiny. **Egg:** Fairly large, broad, oval capsule. Micropylar plate broad, running whole length of egg. Capitulum surrounded by an unusual flimsy structure.

***Pachymorpha* Gray**

World: 13 species. Australia: 3 species.

Characteristics: Stocky, small wingless phasmids, strong central longitudinal line, generally rather rugged appearance, whether stout or more elongate, with pair of spines between eyes, sometimes on a raised ridge. Usually has tubercles, possibly spines, from back of head to first abdominal segment. Head longer than wide, eggs small. Antennae short, not reaching end of fore femora; shorter in male; basal segment considerably broadened. Pronotum shorter than head. Mesonotum variable, 3.5–4 × length of pronotum. Metanotum shorter than mesonotum. Abdomen with conspicuous ridges; final segments may be unusually shaped when viewed laterally. Operculum rounded at tip, reaching up to half the length of anal segment, which is beak-shaped. Latter abdominal segments in some males rounded, of rather swollen appearance, anal segment then very narrow pronged structure; subgenital plate broad, rounded at tip, reaching end of 9th abdominal segment. Cerci short. Legs robust, smooth. **Egg:** Large, broad, oval capsule. Operculum convex with a rough surface. Micropylar plate broadened towards hind part, with a slight central line. **Note:** There are several undescribed *Pachymorpha* species, mainly from New South Wales, but also South Australia and Victoria, warranting a revision of the genus. It is likely that true *Pachymorpha* are limited to Australasia. **Distribution:** Australasia, Africa, Madagascar, Asia.

Key to *Pachymorpha* species

1a Elongate for the genus; spiny head, thorax and abdomen	<i>P. spinosa</i>
1b Elongate or stout; head double-spined or lobed, thorax and abdomen without spines.....	2
2a Elongate, latter abdominal segments not raised.....	<i>P. simplicipes</i>
2b Stout, abdominal segments 8 & 9 considerably raised.....	<i>P. squalida</i>

Subfamily Eurycanthinae

A group of 102 New Guinean and Western Pacific phasmids. They are robust, small to large, dark brown or black wingless, spiny species with long antennae; females often have a beak-like ovipositor, designed for laying eggs in the soil. There are only three Australian representatives, including *Dryococelus australis*, where a captive breeding programme is in place to help conserve this spectacular species.

Key to genera

1a Small to medium, robust, but reasonably elongate, often spiny	<i>Neopromachus</i>
1b Medium to large, broad bodied, spiny	2
2a Thorax with lateral spines; anal segment and operculum of female prolonged to form a long, beak-like ovipositor	<i>Eurycantha</i>
2b Thorax lacking lateral spines; anal segment of female not prolonged, the operculum extends well beyond end of abdomen, forming a chute	<i>Dryococelus</i>

Dryococelus Gurney

World: 1 species. Australia: 1 species.

Characteristics: Large, wingless, broad-bodied insects. Body shining, smooth except for pleurae, which are smooth, tuberculate, or weakly spined. Head broad, about as wide as long, eyes large. Antennae simple, moderately long, longer in male. Pronotum slightly longer than head. Mesonotum about twice length of pronotum, metanotum less than half the length of mesonotum. End of anal segment in male truncate; subgenital plate exceeding end of 9th abdominal segment. Female operculum extending well beyond end of anal segment, forming a chute. Cerci short. All legs robust, spiny; hind femur of male greatly enlarged, heavily spined. **Egg:** Large, oval, heavily sculptured capsule, including almost flat operculum. Broad micropylar plate present on lower half.

Eurycantha Boisdual

World: 10 species. Australia: 1 species.

Characteristics: Medium to large, wingless, broad-bodied, robust insects. Whole body surface dorsally granulated, tuberculate or spined. Head broad, about as wide as long, eyes large. Antennae simple, moderately long, longer in male. Pronotum usually slightly longer than head. Mesonotum about twice length of pronotum, metanotum considerably less than half the length of mesonotum. Thorax with some central spines, but mainly laterally. Abdomen spiny laterally and at hind part of segments. End of anal segment in male triangularly emarginated; subgenital plate not reaching end of anal segment. Female anal segment and operculum extended to form a beak-like, powerful ovipositor. Cerci short. All legs robust, spiny; hind femur of some males enlarged with larger teeth-like spines. **Egg:** Large, oval, mottled or plain capsule, including almost flat operculum. Broad central micropylar plate present. **Distribution:** Australasia.

Neopromachus Giglio-Tos

World: 52 species. Australia: 1 species.

Characteristics: Small to medium, wingless, robust, often spiny insects; body with numerous small tubercles. Armed with a varying number spines, teeth, lobes and crests; typically with spined meso- and metapleurae. Head slightly longer than wide, eyes small. Antennae long, about reaching or just exceeding length of forelegs. Pronotum usually slightly longer than head. Mesonotum $4-5 \times$ length of pronotum; metanotum about half the length of mesonotum. End of anal segment in male subtruncate; subgenital plate exceeding end of 9th abdominal segment. Female operculum extended, forming part of a beak-like ovipositor. Cerci short. Legs slender. **Egg:** Large, oval, mottled or plain capsule, including almost flat operculum. Broad central micropylar plate present. **Distribution:** Australasia.

Subfamily Lonchodinae

A group of about 280 mainly South-East Asian and New Guinean wingless species. They are remarkably slender with long antennae, often found near the ground or in tall grasses. The 10 Australian species are rather understudied and variability within species can be considerable.

Key to genera

Genus	Body	End of anal segment, male	End of anal segment, female
<i>Austrocarausius</i>	Medium-sized, elongate, body heavily granulated.	Incised in centre, rather broadened towards twin-pronged tip.	Subtruncate, supra-anal plate visible.
<i>Denhama</i>	Small to long, remarkably elongate, body smooth or lightly granulated.	Usually incised in centre.	Supra-anal plate rather weakly formed, often a long 'extension' ending in a rounded or almost truncate tip.
<i>Hyrtacus</i>	Small, robust build; body smooth or lightly granulated (spiny in one species).	Usually incised in centre.	Rather beak-shaped, pointed at tip.

***Austrocarausius* Brock**

World: 2 species. Australia: 2 species.

Characteristics: Small to medium, elongate insects variable within each species, often with a pair of spines between eyes. Wingless, body heavily granulated in female. Head elongate, antennae longer than forelegs. Mesonotum $5-7 \times$ length of pronotum, which is similar in length to the head. Metanotum shorter than mesonotum. Legs slender, first segment of fore tarsi broadened. Femora variable, small apical and subapical spines present or absent. Large central lobe sometimes present on slightly broadened fore tibiae in some specimens. Operculum boat-shaped, reaching half the length of anal segment to end of abdomen (male subgenital plate shorter). In female, end of anal segment subtruncate, supra-anal plate visible. End of anal segment in males excised in centre, resulting in a slightly broadened, twin-pronged tip. Cerci short, in both sexes, concealed beneath anal segment. **Egg:** Not quite oval, with network of large cells on capsule, which may have large depressions, unusual in phasmid eggs. Micropylar plate oval, indented. Capitulum on a short stalk.

Key to *Austrocarausius* species

Species	Body	Legs
<i>A. mercurius</i>	Heavily granulated in female (granules often black-tipped).	Femora unarmed. Fore tibiae with one or more foliose lobes. Hind legs reaching end of 6th abdominal segment.
<i>A. nigropunctatus</i>	Irregularly covered with black granulations in female.	Femora with pair of short apical spines; mid femora with 2-3 short subapical spines. Fore tibiae plain, without lobes. Hind legs almost reaching end of abdomen.

***Denhama* Werner**

World: 6 species. Australia: 6 species.

Characteristics: Small to long, often incredibly slender, wingless phasmids, body usually smooth. The head is very elongated. Legs unarmed, moderately long to long. Antennae long, easily exceeding length of fore femora. Operculum exceeding 9th abdominal segment (male subgenital plate similar). Supra-anal plate rather weakly formed, often a long 'extension' ending in a rounded or almost truncate tip. End of anal segment in males usually incised in centre. Cerci short, in both sexes, often concealed. **Egg:** Remarkably long, thin, cigar-shaped capsule. Micropylar plate central only, narrow. **Note:** Found in dry grassy areas, often near the ground; usually grass feeders.

Key to *Denhama* species

	Species	Extension at end of abdomen (females)
1a	Females with long extension at end of abdomen (tip rounded), exceeding length of anal segment.	
	<i>D. aussa</i>	Almost $2 \times$ length of anal segment.
	<i>D. eutrachelia</i>	c. $2 \times$ length of anal segment.
	<i>D. gracilis</i>	c. $3 \times$ length of anal segment.
	<i>D. longiceps</i>	Female may be slender, extension with rounded tip.

1b	Females with short extension at end of abdomen (tip truncate or slightly rounded), not exceeding length of anal segment.	
	<i>D. austrocarinata</i>	Truncate at tip.
	<i>D. striata</i>	Rounded at tip.

***Hyrtacus* Stål**

World: 4 species. Australia: 2 species.

Characteristics: Small and fairly robust, wingless phasmids, body usually smooth, but central spines present on thorax and abdomen in the type species (*tuberculatus*). The head is very elongated. Legs unarmed, moderately long. Antennae long, easily exceeding length of fore femora, sometimes whole leg. Operculum exceeding 9th abdominal segment (male subgenital plate similar). End of anal segment pointed, rather beak-like. End of anal segment in males usually incised in centre. Cerci short, in both sexes, often concealed. **Egg:** Long, sausage-shaped capsule. Micropylar plate narrow, elongate, broader at base; or may be indistinct. **Distribution:** Australasia. **Note:** The two species probably require being placed into different genera, as the spiny/lobed species (another is known from Western Australia) appear to be distinct. To complicate issues with the other plain form, there are similar, undescribed species; one medium-sized boldly striped species from Western Australia has a rounded extension at the end of its abdomen, rather than pointed, although eggs are similar. There is a common species in northern Queensland, similar to *H. caurus*, which will be described as soon as the taxonomic situation becomes clearer. At Laura, this species feeds on *Triodia microstachya*.

Key to *Hyrtacus* species

1a	Spine-like tubercles/lobes on head, thorax and/or abdomen.	
	<i>H. tuberculatus</i>	
1b	No spine-like tubercles/lobes on head, thorax and/or abdomen.	
	<i>H. caurus</i>	

Subfamily Phasmatinae

A group of 62 mostly Australasian phasmids, rarely in Asia. Often large, they are robust, stick-like, usually winged, with moderately long antennae. By far the longest Australian insects, they are at home in woodlands, gardens, parks and in both dry country and rainforests.

Key to genera

Genus	Some key features of body	Operculum (female)	Cerci
<i>Acanthomima</i>	Small to medium; mesonotum with 2–7 spines; fore and hind wings rudimentary.	Exceeding end of 9th abdominal segment.	Very short.
<i>Acrophylla</i>	Medium to giant, elongate; ocelli present; mesonotum sparsely or very spiny/tuberculate; fore and hind wings large, latter may be tessellated or plain.	Extending beyond end of abdomen, forming a chute.	Often long, leaf-like; short in some species.
<i>Anchiale</i>	Medium to large; ocelli present; mesonotum granulated or with cone-shaped tubercles; hind wings short to moderate length in female.	Reaching end of abdomen.	Large, leaf-like.
<i>Anophelepis</i>	Medium, elongate, very short fore and hind wings.	Reaching half the length of anal segment.	Short in female, same length as shortened anal segment in male.
<i>Arphax</i>	Medium to large, very elongate, wingless; mesonotum smooth or with tubercles.	Extending well beyond end of abdomen, forming a chute.	Shorter than anal segment.
<i>Cigarrophasma</i>	Large, broad bodied; mesonotum with spine-like tubercles, front pair largest; fore and hind wings large, hind wings tessellated; legs broad, rather short.	Almost reaching end of abdomen.	Short.
<i>Ctenomorpha</i>	Medium to giant, very elongate; ocelli present (males); mesonotum variably granulated or tuberculate; hind wings short in female, partly tessellated (in male long, plain).	Reaching end of abdomen.	Huge.
<i>Echetlus</i>	Small, elongate, wingless.	Reaching two-thirds length of 9th abdominal segment.	Long, 2 × length of anal segment in female, longer in male.
<i>Eurynema</i>	Large, robust; ocelli present; mesonotum variably tuberculate, some spines; hind wings large.	Extending well beyond end of abdomen, forming a chute.	Long, particularly in male.
<i>Hermarchus</i>	Large, broad-bodied; mesonotum broadened, smooth or granulated, laterally spiny; female wingless, male winged.	Extending well beyond end of abdomen, forming a chute (also with two compressed narrow appendages as long as operculum).	Short.

<i>Onchestus</i>	Medium, wrinkled, broad; spines or tufts likely on head, lobes/crests on femora; wings short in female, possibly in male.	Just exceeding end of abdomen.	Short.
<i>Paractenomorpha</i>	Medium, elongate; ocelli absent; mesonotum granulated and with tubercles; lobes on femora in female, which has short wings.	Short, reaching or just exceeding end of 9th abdominal segment.	Long, leaf-like.
<i>Paronchestus</i>	Medium to large, elongate; head often with pair of spines between eyes, ocelli present; mesonotum may have several spines; wings shortened in female.	Elongate, pointed or rounded at tip, not reaching end of abdomen.	Short.
<i>Ramulus</i>	Medium to large, very elongate, plain, wingless; mesonotum variable, no spines	Reaching or just exceeding end of abdomen.	Short.
<i>Vasilissa</i>	Medium to large, very elongate; mesonotum smooth; fore and hind wings very short; long-winged male form known.	Extending well beyond abdomen.	Shorter than anal segment in female, longer in male.

***Acanthomima* Kirby**

World: 1 species. Australia: 1 species.

Characteristics: Robust, small phasmid. Head longer than wide, may be short, double spined or with tubercles; eyes small. Antennae short, just exceeding half the length of fore femora in male, shorter in female; basal segment broad, ovate. Pronotum noticeably shorter than head. Mesonotum granulated, with two to seven small spines; segment up to $5 \times$ length of pronotum, metanotum considerably smaller than mesonotum. Fore and hind wings rudimentary in female, absent in male. Both male and female with anal segment rounded at tip; subgenital plate in male reaching half the length of 9th abdominal segment. Female operculum exceeding end of 9th abdominal segment. Cerci very short. Legs moderately long, exceeding end of abdomen in male, not in female. All femora spiny, mid and hind femora usually with three well spread serrations; fore femora incurved at base, with several strong serrations, fewer beyond half way. **Egg:** Not known.

Acrophylla Gray

World: 9 species. Australia: 6 species.

Characteristics: Medium- to giant-sized species, cylindrical and slender in both sexes, especially in the males. Head longer than wide. Eyes moderate size; three ocelli present. Antennae moderately long, just exceeding fore femora in female, not quite reaching end of fore tibiae in male. Pronotum about same length as head. Mesonotum $3.25\text{--}4 \times$ length of pronotum, sparsely or considerably spiny, or with numerous tubercles. Fore and hind wings large, although owing to length of female abdomen, only reaching up to about start of 7th abdominal segment (the forewings much longer and broader in females). Operculum large, boat-shaped, extending beyond end of anal segment, subgenital plate in male reaching about end of 9th abdominal segment. Cerci often longer than anal segment and leaf-like, but very shortened in some species. All legs serrate, femora and tibiae; particularly strong on underside in some species. Tarsi usually normal, lobed in one species. **Egg:** Large oval capsule, covered with conspicuous pits, otherwise unsculptured. Elongate micropylar plate, considerably widened towards lower part. **Distribution:** Australasia, China. **Note:** Chinese specimens are likely to belong to another genus.

Key to *Acrophylla* species

Species	Body	Key features
<i>A. caprella</i> (only male known)	Elongate, brown, medium-sized species (underside greyish-white); mesonotum with numerous small, black-tipped spines/tubercles; cerci short.	Hind wings brownish-white, pre-anal part mottled; all tarsi conspicuously lobed; cerci short (probably long and thin in female).
<i>A. enceladus</i>	Large, brown species with heavily spined pronotum and mesonotum; cerci long and leaf-like.	Hind wings tessellated dark brown and white, pre-anal part mottled, inner margin part reddish; large cerci; all femora only slightly serrate.
<i>A. nubilosa</i>	Medium to large, brown species, slightly mottled, with numerous variably sized, but mainly short spines and tubercles on pronotum and mesonotum; cerci long and leaf-like.	Hind wings tessellated dark brown and white (or at least veins brown) in male, pre-anal part plain; in female hind wings black; large cerci; all femora serrate, particularly fore femora.
<i>A. thoon</i>	Moderately long, very slender, grey, green or brown slightly mottled species; female cerci long, but not broad.	Hind wings black (female), whitish-brown (male), pre-anal part plain; inner margin mauve in female; long, narrow cerci (female only); all femora slightly serrate.
<i>A. titan</i>	Large to giant-sized, pinkish-brown species, with sparsely spined pronotum and mesonotum; cerci wavy, long and leaf-like.	Hind wings tessellated dark brown and white, pre-anal part mottled yellowish-brown and black, inner margin part reddish; long, wavy cerci; underside of fore femora strongly serrate, mid and hind femora moderately serrate.
<i>A. wuelfingi</i>	Large, brown species (dark green mesonotum in male) with sparsely spined mesonotum in female, heavily spined in male; cerci very short.	Female forewings with bold cream/whitish band; hind wings dark brown, only inner margin slightly whitish tessellated, pre-anal part mottled yellowish-brown and black; inner margin part reddish (plain in male, which has whitish-brown hind wings); cerci short; underside of fore femora strongly serrate, mid and hind femora moderately serrate.

Anchiale Stål

World: 12 species. Australia: 3 species.

Characteristics: Medium to large, elongate insects. Head rounded, slightly longer than wide. Eyes fairly large, three ocelli present in both sexes, sometimes indistinct in females. Antennae shorter than fore femora in females, longer in males. Pronotum slightly longer than mesonotum, smooth, granulated, or with bold tubercles. Mesonotum 3–4 × length of pronotum; granulated or with moderate number of cone-shaped tubercles. Forewings long, leaf-like, up to half the length of hind wings in female; much shorter in males (sometimes variation within a species). Hind wings variable in length, fairly long in males, but always shortened in females, up to almost end of 5th abdominal segment. Operculum boat-like, only slightly exceeding end of abdomen. Male subgenital plate reaching to about end of abdomen. Cerci leaf-like. All legs evenly spiny, except for fore tibiae. Fore femora in some species only slightly spiny. **Distribution:** Australasia.

Key to *Anchiale* species

Species	Thorax	Wings
<i>A. austrotessulata</i>	Pronotum smooth or granulated, mesonotum with sparse, short black-tipped tubercles (fewer in males, about five pairs).	Forewings in female half the length of hind wings, which are black and white chequered (as in male), not reaching end of 3rd abdominal segment; pre-anal part plain or slightly mottled.
<i>A. briareus</i>	Pronotum granulated, mesonotum with numerous brown or greenish-brown tubercles, short in male, moderately long in female (rainforest); few tubercles (dry eucalypt forest).	Forewings in female less than half the length of hind wings, which are black and white chequered (as in male), exceeding end of 4th abdominal segment (rainforest); but only just exceeding end of 2nd abdominal segment (dry eucalypt forest); pre-anal part plain or slightly mottled.
<i>A. spinicollis</i>	Pronotum (in female only) and mesonotum with moderate number of large brown or greenish-brown tubercles.	Forewings in female half the length of hind wings, which are black and white chequered, not reaching end of 5th abdominal segment; pre-anal part plain or slightly mottled; in male, rather mottled green and brown; male hind wings are whitish, dusky-brown on outer margin.

Anophelepis Westwood.

World: 1 species. Australia: 1 species.

Characteristics: Elongate, medium-sized, with ridges on body. Head longer than wide, eyes small, antennae longer than fore femora in male, not in female. Thorax, and to a lesser extent abdomen, with granules and tubercles. Pronotum same size or shorter than head. Mesonotum 4–5 × length of pronotum, longer than metanotum; occasionally mesonotum in female with a few spines. End of anal segment in female subtruncate, operculum reaching half the length of anal segment. Subgenital plate rounded at tip, reaching half the length of 9th abdominal segment; downwards spur present towards hind part. Cerci short in female, rather longer in male, about same length as shortened anal segment. Fore and hind wings abbreviated. Legs moderately long, all femora with dentations, sometimes only a few near bases. **Egg:** Oval, simple capsule, micropylar plate almost from rim to base. Short capitulum with bold outer circles on operculum.

Arphax Stål

World: 5 species. Australia: 5 species.

Characteristics: Medium-sized to large, very elongate, wingless phasmids. Head much longer than pronotum, eyes small. Antennae about reaching or just exceeding end of fore femora in males, much shorter in females. Mesonotum smooth or with tubercles, $4 \times$ to more than $5 \times$ length of pronotum. Metanotum very short. Operculum elongate, pointed at tip and extending beyond abdomen by more than combined length of 8th–10th abdominal segments, except for *A. australis* group, where it only reaches just beyond end of 9th segment. Subgenital plate in male only reaching half the length of 8th abdominal segment. Cerci shorter than anal segment. Legs with short spines, less conspicuous on forelegs. Forelegs longer than mid and hind legs; hind legs in female not quite reaching abdomen. **Egg:** Rather like *Vasilissa*, oval, plain, glossy pale capsule; micropylar plate a band extending most of capsule length. Capitulum a rather ragged structure. **Note:** Further studies are needed; possibly this genus needs to be split up into the *A. australis* and *A. dolomedes* groups, or even expanded to include the winged *Vasilissa*.

Key to *Arphax* species

	Species	Key features	Cerci
1a	Very short antennae (in male much shorter than fore femora); operculum just exceeding end of 9th abdominal segment = <i>A. australis</i> group.		
	<i>A. australis</i>	Mesonotum smooth.	Moderately long in both sexes.
	<i>A. brunneus</i>	Mesonotum with whitish tubercles (nymph only).	-
	<i>A. michaelseni</i>	Mesonotum with several spine-like tubercles (nymph only).	-
1b	Short antennae (in male longer than fore femora); operculum forming a chute, extending well beyond end of abdomen = <i>A. dolomedes</i> group.		
	<i>A. dolomedes</i>	Plain, although head with dark brown band from eyes to back of head; pronotum with dark blotches.	Moderately long in female, longer in male.
	<i>A. signatus</i>	Usually with whitish head, with black stripe; plain specimens have mottled legs.	Short in both sexes.

***Cigarrophasma* Brock & Hasenpusch**

World: 1 species. Australia: 1 species.

Characteristics: Large, fairly broad-winged phasmids. Head broad, longer than wide; tuberculate; eyes average size, ocelli absent. Antennae long, but shorter than length of foreleg; basal segment broader than remaining segments. Thorax broad in female. Pronotum slightly shorter than head, tuberculate, with central depression. Mesonotum approximately $3 \times$ length of pronotum, with a variable number of large spine-like tubercles; front pair longer and broader than others, particularly in male, and curved forwards; there are a number of other spines, larger in male, and numerous tubercles. Metanotum shorter than mesonotum with smaller granulations. Forewings long and ovate, much broader in female. Hind wings moderately long, tessellated, dark brown and transparent. Legs robust and spiny, lobed in female, moderately long in male, shorter and broader in female. Forelegs considerably broadened in female. All femora with bold pair of apical spines, longer in male; and large subapical spines. Tibiae lobed in female. Tarsi of modest length, first segment of fore tarsi lobed in female. Abdomen slender in male, end of anal segment slightly incised in centre. Subgenital plate swollen, raised in centre, then tapered to slightly rounded tip, exceeding end of 9th abdominal segment. In female body broader, 5th segment rounded laterally; 7th and 8th segments sometimes with lateral leaf-like expansions towards end of segments. End of anal segment subtruncate; supra-anal plate visible, strongly triangular incised in centre. Operculum broad, end slightly rounded, almost reaching end of anal segment. Cerci short in both sexes. **Egg:** Glossy, dark brown or black, almost spherical capsule. Operculum flat, with short capitulum. Micropylar plate a large central, whitish or brown band extending from opercular rim to the posterior pole.

***Ctenomorpha* Gray**

World: 2 species. Australia: 2 species.

Characteristics: Remarkably elongate phasmids, body length 134–300 mm in females, 91–198 mm in males. Rather variable in length, number of tubercles and spines, within species. Head longer than wide, ocelli conspicuous in male. Pronotum similar in length to head. Mesonotum very elongate, $5\text{--}7 \times$ length of pronotum, with few to numerous tubercles. Metanotum short. Antennae fairly long, exceeding length of fore femora in male, but not female. Legs very long and spiny, all femora with pair of short apical spines. Fore femora particularly serrate in female. Forewings elongate, leaf-like. Hind wings full-sized (male), shorter than mid femora in females; pre-anal part of hind wings in female with conspicuous tessellated base, hind wings black and slightly tessellated to a varying degree; in male, wings uniform brown. Operculum elongate, reaching end of abdomen (male subgenital plate reaching to about end of 9th abdominal segment). Cerci huge, several \times longer than anal segment in female, shorter, but still leaf-like in male. (No other known Australian genera have such long, leaf-like cerci in females.) **Egg:** Brown capsule, strongly sculptured, raised in a series of ribs. Micropylar plate almost circular, except sharply pointed at either end. Operculum flat, bearing small stalked capitulum.

Key to *Ctenomorpha* species (apart from size/distribution range)

Species	Underside of mesothorax	Legs
<i>C. marginipennis</i>	Same colour as upperside, lacking central oval patch.	Spiny, male with short spines, several serrations on fore femora only in female.
<i>C. gargantua</i>	Pale, with bold central oval patch.	Spiny, both sexes with large serrations on fore femora; in female and some males, also with two large central serrations on mid and hind femora.

***Echetlus* Stål**

World: 2 species. Australia: 1 species.

Characteristics: Elongate, small to medium-sized, wingless, smooth or slightly granulated phasmids with long cerci. Head longer than wide, eyes small, antennae shorter than fore femora. Pronotum shorter than head. Mesonotum $4.5\text{--}5 \times$ length of pronotum, about $3 \times$ length of short metanotum. Operculum reaching two-thirds of 9th abdominal segment (same with subgenital plate in male). Cerci long, almost twice length of anal segment in female, longer in male. The legs are elongate. **Egg:** Not known. **Distribution:** Australia, South America (Brazil, may not belong to this genus).

***Eurycnema* Serville**

World: 4 species. Australia: 2 species.

Characteristics: Large, robust phasmids, body length 160–230 mm in females, 112–162 mm in males. Variable in length, as well as number of thorax tubercles and spines within species. Head large, longer than wide, with three ocelli, slightly glossy; eyes large. Pronotum similar in length to head, usually slightly shorter. Mesonotum fairly elongate, three to $5 \times$ length of pronotum, smooth, with few to numerous tubercles or spines; metanotum short. Antennae fairly short, exceeding length of fore femora in male, but not female. Legs moderately long and spiny, all femora with pair of apical spines; unlike some other genera, spines may be well spread and relatively few in number. Tibiae sometimes with prominent dorsal lobe or crest at base; hind tibiae sometimes with longer central spines. Forewings very elongate, leaf-like. Hind wings large. Operculum elongate, chute extending well beyond end of abdomen (male subgenital plate reaching to about end of 9th abdominal segment). Cerci long, particularly in male. **Egg:** Capsule large, round or broadly oval, with or without ridges (tufts in *E. goliath* give it a rather different appearance to other species). Micropylar plate of variable size, pear-shaped. Operculum flat, with large capitulum, variable in size. **Distribution:** Australasia and South-East Asia.

Key to *Eurycnema* species

Species	Mesonotum	Legs	Cerci	Eggs
<i>E. goliath</i>	Bluish-green central longitudinal line.	Inner margin of hind tibiae with approximately seven spines, of which the fourth and fifth spines are more than twice as long as broad as the others.	Broad, 2–2.5 × longer than wide (female), 4 × longer (male).	Dark brown, almost oval, capsule largely covered in raised tufts.
<i>E. osiris</i>	Pink central longitudinal line.	Inner margin of hind tibiae with approximately 10 green or brown spines, of which the central spines are only slightly longer than other spines and more spaced apart.	Elongate, more than 3 × longer than wide (female), more than 10 × longer (male).	Grey or light-brown to medium-brown, round or broadly oval, without tufts.

***Hermarchus* Stål** (now in Phasmatidae, tribe Stephanacridini)

World: 10 species. Australia: 1 species.

Characteristics: Large phasmids, broad-bodied in female, slender and elongate in male. Head slightly rounded, longer than wide, eyes moderately large, slightly truncate; front with a black outer margin. Antennae exceeding length of fore femora; basal segment broader. Pronotum about same length or shorter than head, mesonotum narrowed at front, then characteristically very broadened (but only in female); smooth, very sparsely granulated or with spines, including laterally. Mesonotum 3.5–4 × length of pronotum, and 3–4 × length of metanotum, which is also spiny laterally. Legs long, robust, all legs spiny, hind legs exceeding end of abdomen in male, but not in female. Male only winged; forewings small and truncate, hind wings abbreviated or almost full-sized. Operculum elongate, boat-shaped, exceeding end of abdomen (male subgenital plate reaching to end of 9th abdominal segment). The female also has two compressed, narrow elongate appendages as long as the operculum. Cerci short. **Egg:** Oval capsule, broad central micropylar plate. Operculum raised almost cone-like. **Distribution:** Australia, Fiji, New Caledonia.

***Onchestus* Stål**

World: 4 species (other 2 with locality unknown are unlikely to belong to this genus). Australia: 2 species.

Characteristics: Medium-sized phasmids, body wrinkled and broad, particularly in female. Head, pronotum and mesonotum tuberculate, with some spines. Head with or without pair of long spine-like protuberances slanting backwards (male), and sometimes with a pair of large tuft-like protuberances (female), which is variable within species and may be absent. Triangular central slightly raised area between eyes. Antennae with 22–25 segments, reaching or exceeding length of fore femora; basal segment very broadened. Legs long, all femora with pair of apical spines. Central carina of fore femora very dentate; mid- and hind femora less dentate, but with variable number and lobes and/or crests, largest on mid femora. Forewings elongate, leaf-like. Hind wings abbreviated or almost full-sized (male), shorter than normal in females; pre-anal part of hind wings with conspicuous black base,

hind wings black and white tessellated to a varying degree. Operculum elongate, just exceeding end of abdomen (male subgenital plate about half the length of 9th abdominal segment). Cerci short, almost concealed in female, longer in male. **Egg:** Unusually shaped large capsule, with four sides when viewed from operculum. Capitulum small, on a short stalk. Micropylar plate with central, oval area, inset into the capsule. Capsule with numerous ridges and pits. **Distribution:** Australia and unknown. There is an undescribed species from Yamdena Island, Indonesia, so far known from a single male.

Key to *Onchestus* species

Species	Head	Hind wings	Operculum (female)
<i>O. gorgus</i>	Lacking pair of large tuft-like protuberances in both sexes.	Short, not reaching end of 3rd abdominal segment in male, shorter than combined length of head to mesonotum in female.	Slight basal lobe.
<i>O. rentzi</i>	Usually with pair of large tuft-like protuberances, pointing backwards in male and female.	Moderately long, reaching beyond end of 5th abdominal segment in male, exceeding combined length of head to mesonotum in female.	Conspicuous basal lobe.

Paractenomorpha Hennemann & Conle

World: 1 species. Australia: 1 species.

Characteristics: Medium-sized, elongate phasmids, the genus initially included a synonym of *Ctenomorpha marginipennis*, in error. These revised notes are based on three specimens of the type species. Head longer than wide, ocelli absent. Pronotum shorter than head. Mesonotum very elongate, c. $5 \times$ length of pronotum, minutely but heavily granulated in female, with a few larger tubercles; male with numerous larger tubercles. Metanotum short (median segment longer). Antennae fairly long, easily exceeding length of fore femora in male (but not female). Legs moderately long and spiny, all femora with pair of short apical spines. In female, lobes present on mid femora, mid and hind tibiae. Forewings elongate, leaf-like. Hind wings almost full-sized (male) reaching just over end of 6th abdominal segment, but shorter than mid femora in females; female hind wings greyish-black; in male, wings uniform brown. Underside of 6th abdominal segment, with paired lobes at hind margin. Upperside of hind part of 5th segment with raised lobe. End of anal segment with slight central incision. Operculum short, reaching or just exceeding end of 9th abdominal segment (as in male subgenital plate). Cerci elongate in female (but much less than in *Ctenomorpha*), shorter, but still leaf-like in male. **Egg:** Medium-sized, ovoid. Capsule surface slightly wrinkled. Operculum flat, almost circular, bearing small stalked capitulum. **Note:** A species of similar general appearance has been found in Jurlen, Western Australia. However, it has short wings and short cerci in both sexes.

Paronchestus Redtenbacher

World: 3 species. Australia: 3 species.

Characteristics: Medium to large, elongate but robust-looking winged phasmids, females with short hind wings. Head and thorax and often abdomen usually granulated, also with numerous tubercles and sometimes a varying number of spines, from one or two to several, but variable within each species. Head longer than wide, about same length as pronotum; often with a pair of horns between eyes (in males and some females). Eyes moderate size; three ocelli present in males, less conspicuous in females. Antennae about reaching half the length of fore tibiae in females, longer in males. Mesonotum $3.5\text{--}5 \times$ length of pronotum, sometimes with varying number of spines within each species, from two to several, usually more in males. Metanotum very short, less than half the length of mesonotum. Operculum elongate, pointed or rounded towards tip; variable, but not reaching end of abdomen. Anal segment in female very elongate. Lower part of subgenital plate in male only with extended structure that may reach or exceed end of 9th abdominal segment. Cerci short. All legs moderately long and spiny (fore tibiae sometimes indistinctly), sometimes with larger lobes or dentations (particularly mid and hind femora); hind legs in female well short of end of abdomen. Forewings large in females, half the length of hind wings (one quarter in males; rather raised); pre-anal part of hind wings with bold black blotch near inner margin, hind wings chequered, large in male, in female rarely reaching beyond end of 4th abdominal segment. **Egg:** Capsule dark, oval; micropylar plate a bold pale band extending from just below base of operculum to beyond the posterior pole, where it is keel-shaped.

Key to *Paronchestus* species

Species	Subgenital plate (male)	Operculum (female)
<i>P. charon</i>	Short, reaching to half the length of 8th abdominal segment.	Not known.
<i>P. cornutus</i>	Reaching to end of 9th abdominal segment.	Not reaching one-third the length of anal segment.
<i>P. pasimachus</i>	Leaf-like extension, just exceeding end of 9th abdominal segment.	Elongate, almost reaching end of anal segment.

Note: While thoracic spines are also useful features, they do vary considerably within species, whereas the genitalia are consistent within each species.

Ramulus Saussure

World: 174 species. Australia: 1 species.

Characteristics: Medium to large, very elongate, wingless phasmids, with short antennae. Cerci short. Not clearly distinguished from related genera. **Egg:** Flat, oblong and more or less slender, very distinctive. **Distribution:** Australia, Asia.

***Vasilissa* Kirby**

World: 1 species. Australia: 1 species.

Characteristics: Medium-sized to large, very elongate phasmids; both sexes with modest size forewings and short hind wings. However, some males are fully winged (hind wings chequered). Head longer than pronotum, eyes small. Antennae about reaching or just exceeding end of fore femora in males, shorter in females. Mesonotum smooth, $4\text{--}5 \times$ length of pronotum; metanotum very short. Operculum elongate, pointed at tip and extending beyond abdomen by more than combined length of 8th–10th abdominal segments. Subgenital plate in male only, reaching to half the length of 8th abdominal segment. Cerci slightly shorter than anal segment (female); longer in male. Mid and hind legs with short spines, occasionally forelegs also, but less conspicuously. Forelegs longer than mid and hind legs; hind legs in female not reaching 8th abdominal segment. **Egg:** Rather like *Arphax*, oval, plain glossy pale capsule; micropylar plate a band extending most of capsule length. Capitulum large.

Subfamily Platycraninae

A group of 59 species mainly from Pacific Islands, including a well-known pest on coconut. Species are stout, often with shortened wings, occasionally wingless; antennae of moderate length. There are two Australian representatives, including the spectacular bluish-green *Megacrania batesii*, which lives in the midribs of pandanus leaves. The genera *Anophelepis* and *Echetus*, previously members of this subfamily, have been transferred to the subfamily Phasmatinae.

Key to genera

Genus	Operculum (female)	Wings
<i>Davidrentzia</i>	Extends well beyond end of abdomen.	Vestigial wings only.
<i>Megacrania</i>	Not extending beyond end of abdomen.	Short to medium-sized wings.

***Davidrentzia* Brock & Hasenpusch**

World: 1 species. Australia: 1 species.

Characteristics: Robust, medium-sized phasmid, body length c. 97 mm in females, male not yet known. Head large, rather broad (but longer than wide), with series of granules present; eyes small. Antennae with 24 segments (type species), basal segment broadened, 2nd segment longer also than next. Final segment $2.5 \times$ longer than previous segment. Thorax broad, rugged appearance, heavily granulated/tuberculate, including laterally. Pronotum significantly shorter than head, mesonotum nearly $3 \times$ longer than pronotum. Metanotum almost $3 \times$ shorter than mesonotum. Vestigial wings only present. The abdomen is broad, with several longitudinal ridges; end of anal segment slightly emarginated in centre. Operculum large, boat-shaped, exceeding abdomen by length of anal segment. Cerci broad, tapered to tip. The legs are robust, with a pair of short apical spines on femora. Otherwise the femora and tibiae have short spines, hardly noticeable on the tibiae. **Egg:** Not known.

Megacrania Kaup

World: 12 species. Australia: 1 species.

Characteristics: Rather broad, medium-sized, robust insects, with a large head and often abbreviated wings. Thorax often with numerous tubercles. Cerci short, wide and flattened. Operculum not extending beyond end of abdomen. **Egg:** Large capsule, with little, if any sculpturing; micropylar plate fairly small. Operculum conical. **Distribution:** Australasia, Asia.

Subfamily Tropicoderinae

A group of 30 robust, often broad-bodied (in females) species. Short and/or long-winged Australian species belong to the tribes Extatosomatini and Tropicoderini and are often associated with eucalypts. Antennae moderately long, although shorter than femora in some females. Includes the pest species *Didymuria violescens* and *Podacanthus wilkinsoni*. The Monandropoterini are known from the East Indies (Madagascar, Mauritius and Réunion).

Key to genera

	Genus	Body	Hind wings	Femora (in male)
1a	Back of the head with spined cone-like elevation; femora and tibiae leaf-like and irregularly dentate.			
	<i>Extatosoma</i>	Large, broad-bodied spiny female with rudimentary wings; male slenderer and less spiny	Female rudimentary only; male, large, tessellated black/dark brown and whitish.	Partly spiny with broad leaf-like lobes.
1b	Back of the head not conically elevated; femora and tibiae without large, leaf-like teeth.			
	<i>Didymuria</i>	Small to medium-sized. Male slender, female broad, spool-like; cerci long.	Moderate-sized wings in male (can be brightly coloured), shortened in female.	Mid and hind femora spiny; latter thickened, sometimes with three conspicuous larger spines.
	<i>Lysicles</i>	Medium-sized, both sexes elongate; cerci long.	Moderate length in male; short in female, but visible beneath short, oval forewings.	Mid and hind femora spiny; latter elongate, sometimes with three conspicuous larger spines.
	<i>Malandania</i>	Medium-sized, robust in both sexes; mesonotum spiny, including laterally in female; cerci short.	Large wings in both sexes.	Mid and hind femora spiny.
	<i>Micropodacanthus</i>	Small, robust in both sexes; mesonotum with several conspicuous tubercles, perhaps spine-like, varying in size; cerci long.	Large wings in both sexes.	Sparse spines on mid and hind femora.
	<i>Parapodacanthus</i>	Medium-sized; mesonotum short and narrow, with large spine-like tubercles, front pair horn-like; cerci long.	Large wings in both sexes.	Mid and hind femora spiny.

	<i>Paratropidoderus</i>	Medium-sized, elongate (only male known); mesonotum with series of bold, orange, conical spine-like tubercles; cerci broad, leaf-like, but short.	Large wings (male); female not yet known.	Mid and hind femora spiny.
	<i>Podacanthus</i>	Medium-sized to large; mesonotum short and narrow, with series of even sized, spine-like tubercles; cerci long.	Large wings in both sexes.	Mid and hind femora spiny.
	<i>Tropidoderus</i>	Medium-sized to large; elongate in male, females rather broadened; mesonotum granulated, in females broad and serrated laterally; cerci long.	Large wings in both sexes.	Mid and hind femora spiny, broadened, often significantly leaf-like.

***Didymuria* Kirby**

World: 3 species. Australia: 2 species.

Characteristics: Small to medium-sized; males slender with long wings; females thicker, spool-like, with shortened wings. Head small, elongate, hind part rounded. Eyes moderately large, no ocelli. Antennae shorter or longer than fore femora in male; considerably shorter in female. Pronotum about same size or shorter than head. Mesonotum granulated, about 3 × length of pronotum. Metanotum shorter than mesonotum. Cerci elongate. Forewings oval, about one quarter to one third length of hind wings, which are moderately long in male, considerably shortened in female. Forelegs unarmed and longer than hind legs, which do not reach end of abdomen; underside of mid and hind femora spiny, hind femora in males thickened, sometimes with large central spines. Mid and hind tibiae less conspicuously spiny. **Distribution:** Australasia.

Key to *Didymuria* species

Species	Antennae	Hind wings	Hind femora (male)
<i>D. violescens</i>	In male, longer than fore femora; in female only reaching half the length of fore femora; 20–21 segmented.	In male, violet or dark brown exceeding end of 4th abdominal segment (forewings one third the length of hind wings). In female, whitish, pink-tinged or pink, reaching to about end of 3rd abdominal segment.	With three larger spines.
<i>D. virginea</i>	In male, shorter than fore femora; in female only reaching half the length of fore femora; 23 segmented.	In male, brown, exceeding end of 6th abdominal segment (forewings one quarter the length of hind wings). In female, whitish, reaching to about end of 4th abdominal segment.	Lacking larger spines.

***Extatosoma* Gray**

World: 2 species (both with subspecies). Australia: 1 species.

Characteristics: Large; body broad and spiny in female, slenderer and less spiny in male. The male is winged, female with rudimentary wings. Head large, hind part conical and spiny. Three ocelli distinct in male, lacking in female. Antennae of moderate length (much longer in male), only reaching just over length of fore femora in female. Mesonotum broadened in female, not twice length of pronotum. Forewings leaf-like; in male, oval, as long as metanotum; in female, broader, but little over half the length of metathorax. Hind wings of male large, reaching to about end of abdomen. In female shrivelled and rudimentary (shorter than forewings). Abdominal segments greatly expanded laterally, particularly 5th–7th segments. In female, paired central leaf-like structures present on abdominal segments. Legs moderately long to short; femora and tibiae spiny, broadened and leaf-like, particularly in female. Mid and hind tibiae with apical hooked spine. Female with large boat-shaped operculum extending well beyond end of abdomen; valves long, filamentous, curved at tip. Subgenital plate in male boat-shaped, reaching end of abdomen, ending in a closed tube. **Egg:** Capsule oval, with conspicuous, broad, slightly raised micropylar plate, extending full length of dorsal surface. Capitulum present. **Distribution:** Australasia.

***Lysicles* Stål**

World: 2 species. Australia: 2 species.

Characteristics: Elongate, medium-sized to large phasmids (females also elongate, much less plump than in other genera). Head longer than wide, pronotum about same size as head, or slightly shorter. Antennae short, longest in male, but still shorter than fore femora. Mesonotum long, may have numerous tubercles, about 4–5 × length of pronotum. Metanotum shorter than mesonotum. In female forewings oval, very shortened; hind wings likewise, but visible beneath forewings. In male, forewings again very short, but hind wings moderately long, about 7–8 × length of forewings. Abdomen elongate, all segments longer than wide; operculum reaching about end of 9th abdominal segment, as with subgenital plate in male. Cerci much longer than anal segment in both sexes. Legs elongate, but hind legs not quite reaching end of abdomen. Mid and hind femora spiny, also hind tibiae. In males, hind femora may have up to three particularly long spines, well spaced.

Key to *Lysicles* species

Species	Body	Cerci	Wings in male
<i>L. hippolytus</i>	Elongate.	1.5 × length of anal segment (female), some 2 × length in male.	Broad, pale green margin on fore and pre-anal part of hind wings.
<i>L. periphanes</i>	Very elongate, particularly thorax and abdomen.	In excess of 2 × length of anal segment (female), over 3 × in male.	Variegated; forewings with a whitish patch.

***Malandania* Sjöstedt**

World: 1 species. Australia: 1 species

Characteristics: Robust, medium-sized phasmids. Head large, as broad as long. Eyes fairly large; three ocelli present in male. Antennae long, but shorter than length of foreleg. Pronotum about same length as head, granulated. Mesonotum broad in female, rugged appearance, with numerous granules and tubercles, including laterally. In male, narrow, but with about 15, mainly large spine-like tubercles; mesonotum moderately long in Tropicoderinae, just under $2.5 \times$ length of pronotum. Metanotum shorter than mesonotum. Forewings very oval, broad and leaf-like, reaching half the length of hind wings in female, but fairly short in male. Hind wings large, but not reaching end of abdomen. Abdomen broad in female, slender in male. End of anal segment in female tapered to almost rounded tip. Operculum large, boat-shaped, about reaching end of anal segment; in male end of anal segment divided into two triangular lobes, four black-tipped teeth visible within. Cerci short and incurved, broad at base, tapering to tip. Subgenital plate swollen, rounded at tip, not reaching end of 9th abdominal segment. The legs are robust, reasonably long; hind legs reaching to about end of abdomen. All femora with apical spine. Mid and hind legs spiny, tibiae less so. **Egg:** Not known.

***Micropodacanthus* Brock & Hasenpusch**

World: 2 species. Australia: 2 species.

Characteristics: Robust, small phasmids, body length c. 43 mm in males, 53–66 mm in females. Head large, as broad as long, with series of granules present. Eyes large; three ocelli present. Antennae long, with 25–28 segments, but shorter than length of foreleg. Mesonotum broad, rugged appearance with numerous granules and/or tubercles, including laterally. Pronotum slightly shorter or same length as head, mesonotum short, slightly longer than pronotum, with several conspicuous tubercles, perhaps spine-like, varying in size. Metanotum not quite $1.5 \times$ length of mesonotum. Underside of thorax lighter; as in *Podacanthus*, posterior with an oval central area. Forewings very long and leaf-like, hind wings also long, reaching to end of abdomen. Abdomen broad, carina either side of median line. End of anal segment in female boldly triangular incised, supra-anal plate may be visible. Operculum large, boat-shaped, reaching to about end of anal segment; in male end of anal segment divided into two lobes. Cerci about as long as anal segment, broad, tapering to tip. Subgenital plate swollen, subtruncate at tip, not reaching end of 9th abdominal segment. The legs are robust, rather hairy (in type species) reasonably long, hind legs about reaching end of abdomen. All femora with apical spine. Mid and hind femora with several well spaced serrations ventro-laterally, hardly noticeable on the tibiae. Tarsi of modest length. **Egg:** Capsule tall, curved. With fine net-like sculpturing, but lacking the distinctive raised sculpturing in *Podacanthus*. Small, oval micropylar plate situated near pole, median line beneath. Capitulum raised, operculum pitted. **Note:** While the two described species are known from just a few specimens from northern Queensland, there is a male of an, as yet, undescribed species from south-east Queensland.

Key to Micropodacanthus species

Species	Mesonotum	Hind wings	Legs
<i>M. sztrakai</i>	Green with wide, brown, central band; several large spine-like tubercles.	Tessellated pink and white.	Rather hairy.
<i>M. mouldsi</i>	Greenish, with bold, black, longitudinal central line; several less conspicuous tubercles.	Whitish, all one colour.	Slightly hairy.

***Parapodacanthus* Brock**

World: 1 species. Australia: 1 species.

Characteristics: Closely related to the genus *Podacanthus*, but easily distinguished by the presence of large spine-like tubercles on the mesonotum, in addition to differences in egg structure. Head slightly longer than wide, eyes large; three ocelli present. Antennae long, but shorter than foreleg. Pronotum slightly longer than head, with central impression. Mesonotum short, just over $1.5 \times$ length of pronotum, with four pairs of large brown spine-like tubercles, the front pair much longer, rather horn-like. The other spines slant outwards. Metanotum slightly longer than mesonotum, small tubercles laterally. Forewings long and slender, hind wings large, with darker veins. Legs moderately long and slender, fore femora smooth, mid and hind femora spiny. Abdomen slender, in male anal segment twice length of 9th segment, split into large lobes, broad dorsally then narrowing, ending in a club. Lobes form an expanded, circular arch-like structure. Subgenital plate swollen, raised in centre, reaching beyond end of 9th abdominal segment. In female, operculum long and narrow, rounded at tip, reaching beyond end of anal segment. Cerci longer than anal segment, broadened and leaf-like, slightly pointed at tip; overlapping or incurved. **Egg:** Small, oval, slightly hairy capsule with numerous raised ridges and a knob-like capitulum on a stalk. Micropylar plate small, upper part not reaching half the length of capsule.

***Paratropidoderus* Brock & Hasenpusch**

World: 1 species. Australia: 1 species.

Characteristics: Elongate, body length 87–101 mm in male (female not yet known). Head much longer than wide. Eyes large. Antennae longer than fore femora, with c. 24 segments; basal segment broader and twice length of second segment. Pronotum much shorter than head. Mesonotum almost $4 \times$ length of pronotum, with series of conspicuous conical, paired spine-like tubercles. Smaller tubercles present laterally and ventrally. Metanotum conspicuously shorter than mesonotum. Forewings long, leaf-like, hind wings also fairly long, reaching end of 6th abdominal segment. Abdomen slender. End of anal segment margins rounded, slightly incised in centre. Subgenital plate swollen, subtruncate at tip, reaching end of 9th abdominal segment. Cerci broad, leaf-like, but short for *Tropidoderinae*. Legs long, hind legs reaching to about end of abdomen. Mid and hind legs spiny. From the general appearance, *Paratropidoderus* looks closest to *Tropidoderus*, but it is easily distinguished by the spine-like tubercles on the mesonotum (lacking in *Tropidoderus*). *Paratropidoderus* also has short cerci (long in *Tropidoderus*). **Egg:** Not known.

***Podacanthus* Gray**

World: 4 species. Australia: 4 species.

Characteristics: Robust, medium-sized to large phasmids. Head small, longer than broad. Eyes globular, three ocelli present. Antennae moderately long, not reaching end of foreleg. Pronotum at least slightly shorter than head. Mesonotum short, up to $2 \times$ length of pronotum (usually little more than $1 \times$ length), narrow, with spine-like tubercles. Metanotum longer than mesonotum. Forewings very long and leaf-like, almost half the length of wings in female, one-third the length in males. Hind wings also long, sometimes reaching beyond end of abdomen in females (in one species only to 7th abdominal segment). Abdomen broad in females. End of anal segment in female slender, subtruncate at tip, may be triangularly incised. Operculum large, boat-shaped, reaching up to end of anal segment; in male end of anal segment curved or arched, split into double lobed structure, with incurving arms. Subgenital plate swollen, not reaching end of 9th abdominal segment. Cerci in both sexes moderately to very long, $1\text{--}5 \times$ length of anal segment. The legs are moderately long, with hind legs well short of end of abdomen. Mid and hind femora spiny. **Egg:** Capsule oval or rectangular. Variable, but often with large, raised sculpturing. Central micropylar plate. Capitulum large, raised, often conical.

Key to *Podacanthus* species

	Species	Body	Wings
1a Mesonotum elongate, more than $2 \times$ length of pronotum.			
	<i>P. keyi</i>	Uniform green or brown, fairly elongate.	Hind wings whitish with a pink tinge (male), pink in female, also inner margin of pre-anal part of hind wings with large yellowish blotch; wings reach c. end of 9th abdominal segment.
1b Mesonotum less than $2 \times$ length of pronotum (often about same length).			
	<i>P. typhon</i>	Uniform green or brownish, largest female in genus; cerci long for genus, up to $c. 5 \times$ length of anal segment.	Large pink wings exceed end of abdomen in female; inner margin of pre-anal part of hind wings pink or red.
	<i>P. viridiroseus</i>	Uniform green or brown, fairly elongate (male with two-tone forewings and pre-anal part of hind wings), cerci moderately long, up to $c. 2 \times$ length of anal segment; male anal segment not strongly arched.	Often deep pink, inner margin of pre-anal part of hind wings may be yellowish. Wings exceed end of abdomen in female.
	<i>P. wilkinsoni</i>	Greenish-brown (male with two-tone forewings and pre-anal part of hind wings), stocky appearance, cerci $1\text{--}2 \times$ length of anal segment; male with strongly arched anal segment.	Hind wings whitish-pink, with a hint of dusky brown. Wings short in female, reaching c. end of 7th abdominal segment.

Tropidoderus Gray

World: 7 species. Australia: 5 species.

Characteristics: Large body size, males elongate, females rather broadened. Head flat, longer than broad. Eyes small, no ocelli. Antennae exceeding fore femora in male, but not in female; basal segment flattened and broad. Pronotum about same length as head, mesonotum in females broad and serrated laterally, at least twice as long as pronotum (narrow in males). In both sexes, mesonotum granulated. Abdomen of male slender, cylindrical (subgenital plate not reaching beyond end of 9th abdominal segment). In female, abdomen tapering to tip; operculum large, boat-shaped, extending slightly beyond abdomen. Forewings oval, long, leaf-like. Hind wings broad, often with colourful basal area; hind wings usually transparent, but can be tessellated in male; wings large, but not reaching end of abdomen. Legs fairly long, mid and hind femora strongly serrated; in female, often broadened and leaf-like. Cerci moderately long in males, longer in females. **Distribution:** Australasia and unknown.

Key to *Tropidoderus* species

	Species	Body	Colour of inner margin, pre-anal part of hind wings (female)*	Shape of mid and hind femora in female
1a	Male hind wings tessellated; female large, very broadened mesonotum.			
	<i>T. michaelsoni</i>	Cerci in male more than twice length of anal segment.	Red.	Very broadened.
	<i>T. rhodomus</i>	Cerci in male about same length as anal segment.	Red.	Broadened.
1b	Male hind wings plain, not tessellated; female medium to large, mesonotum slightly to conspicuously broadened.			
	<i>T. childrenii</i>	Mesonotum broadened.	Bluish-mauve, possibly with red also.	Broadened.
	<i>T. gracilifemur</i>	Mesonotum only slightly broadened.	Red.	Slightly broadened.
	<i>T. prasina</i>	Mesonotum broadened.	Bluish-mauve.	Broadened.

*Note: This feature is conspicuous on most, but not all dead specimens.

Subfamily Xeroderinae

A Melanesian and New Guinean group of 20 winged species, with moderately long antennae. The only Australian representative occurs on eucalyptus bark and branches in Queensland, where it is remarkably well camouflaged.

Xeroderus Gray

World: 2 species. Australia: 1 species.

Characteristics: Antennae in females slightly longer than fore femora, in males longer and bristly; pronotum plain, lateral margins dilated and elevated; mesonotum with spine-like tubercles, roundly-dilated at the front, in males slender; forewings and hind wings are moderately large in both sexes; abdomen in males slender, cylindrical, in females laterally depressed, all segments laterally with angled lobes. All femora spiny. Cerci short. **Egg:** Not known. **Distribution:** Australasia.

Subfamily Phylliinae

These are the true broad-bodied, leaf insects, mainly South-East Asian and New Guinean (46 species). While males have long antennae, those in females (and nymphs of both sexes) are tiny. There are only three rarely reported Australian representatives, all of which are found in the rainforests of northern Queensland.

Key to genera

Genus	Body shape (female)	Head	Mesonotum	Forewing in male	Hind wing in male
<i>Chitoniscus</i>	Rather broad, medium-sized.	Hind part with one central tubercle or spine.	Transverse.	Long, leaf-like.	Transparent.
<i>Nanophyllium</i>	(Female not known, believed to resemble <i>Phyllium</i>).	Hind part with two central tubercles.	Square.	Very short.	Iridescent, white, brown, or transparent.
<i>Phyllium</i>	Broad, medium-sized to large, more elongate.	Hind part with one central tubercle or spine.	Square.	Long, leaf-like.	Transparent.

Chitoniscus Stål

World: 6 species. Australia: 1 species.

Characteristics: Medium-sized, head about as long as wide; hind part with one central tubercle or spine; eyes small. Antennae long in male, very short in female. Mesothorax in front of forewings transverse. Mid sternum with distinct central spine. Forewings in male long, leaf-like; in female extended beyond wings. Hind wings transparent. In males, vomer triangular. **Distribution:** Australasia, Fiji, New Caledonia.

Nanophyllium Redtenbacher

World: 6 species. Australia: 1 species.

Characteristics: Elongate, small, body length c. 30 mm in male (female not yet known). Head as long as wide; hind part with two central tubercles; eyes small, antennae long. Mesothorax in front of forewings square. Mid sternum without distinct central spine. Forewings very short; hind wings slightly iridescent, transparent, white or brown. Vomer elongate, twice as long as wide. **Distribution:** Australasia.

***Phyllium* (*Phyllium*)** Illiger

World: 25 species. Australia: 1 species.

Characteristics: Medium-sized to large; body leaf-like; abdominal segments strongly broadened. Head as long as wide; hind part with one central tubercle or spine; eyes small. Antennae long in male, very short in female. Mesothorax in front of forewings about square. Forewings in male long, leaf-like; in female extended beyond hind wings. Hind wings transparent. All femora, especially the four fore femora at least in females, with leaf-like dilations on interior and exterior. Mid tibiae with exterior lobes only. Males with triangular vomer. **Distribution:** Tropical Asia, Australasia.

Appendix 2: Classification of phasmids

There is varying opinion about the higher classification of the Phasmida (Phasmatodea is used by many authors) and little phylogenetic work has been undertaken. The names originate from the Greek *phasma*, meaning apparition, spectre or spirit, and some taxonomists consider that the popular 'Phasmida' is improperly formed, although it has the advantage of being the oldest name, simplest and close to the commonly used name of 'phasmids'. Who is right? The answer is: it is up to each author, as the names of insect orders are not subject to specific rules within the International Code of Zoological Nomenclature. To further confuse matters, other ordinal names are also sometimes used by authors, such as Cheleutoptera and Phasmatoptera.

When describing insects, scientists communicate the results of their research to the scientific community and the general public. In 1758 Carolus Linnaeus published *Systema Naturae*, a system of classification still in use today. The taxonomic hierarchy, using *Acrophylla titan* (Macleay) of the Family Phasmatidae as an example is:

Order: Phasmida

Suborder: Verophasmatodea

Infraorder: Anareolatae

Family: Phasmatidae

Subfamily: Phasmatinae

Tribe: Phasmatini

Genus: *Acrophylla*

Species: *titan*

For detailed information, consult the Phasmida Species File on-line: <<http://phasimida.speciesfile.org>> Some authors have differing opinions, but the genus and species names remain the same, even if changes are made to Higher Classification.

The following is a summary of key literature on phasmids (such as monographs and catalogues), which have advanced research on these insects. Major publications on Australian phasmids are also included:

- 1833 Gray. *The Entomology of Australia in a Series of Monographs. Part 1. The monograph of the genus Phasma*. Includes eight beautiful hand-coloured plates of species. Gray also published his catalogue of the Phasmidae in 1835, listing 134 species and several 'doubtful' species.
- 1859 Westwood. *Catalogue of Orthopterous Insects in the Collection of the British Museum. Part 1, Phasmidae*. The first major illustrated work on phasmids with 48 plates. 471 species are mentioned, many described by Westwood, with the type material deposited in London or Oxford.
- 1875 Stål. A major reclassification of the order, including some new descriptions.

- 1897 Rainbow. A catalogue of Australian phasmids.
- 1902 Tepper. An updated catalogue of Australian phasmids.
- 1904 Kirby. *A Synonymic Catalogue of Orthoptera*. A comprehensive catalogue of species, including references to species in the British Museum (Natural History) collection, with new synonymy. Unfortunately, Kirby's catalogue was not taken into consideration by Brunner von Wattenwyl and Redtenbacher (see next entry).
- 1906–08 Brunner von Wattenwyl and Redtenbacher. *Die Insektenfamilie der Phasmiden*. Monograph published in three parts (Redtenbacher 1906 & 1908, Brunner 1907), with 1899 species and basic keys to genera and species. Whilst descriptions are often brief, this is still a major source of reference for researchers. Type specimens are deposited in many European museums, particularly Vienna.
- 1918 Sjöstedt. *Results of Dr E. Mjöberg's Swedish Scientific Expeditions to Australia 1910/1913. 17. Mantidae and Phasmidae*. Several new species descriptions and other notes; the type material is in Stockholm.
- 1953 Günther. *Über die taxonomische Gliederung und die geographische Verbreitung der Insektenordnung der Phsmatodea*. A reclassification of the order, in German.
- 1970, 1991 Key. Phsmatodea. In: *The Insects of Australia*. Follows the classification of Günther.
- 1977 Bradley and Galil. The taxonomic arrangement of the Phsmatodea with keys to the subfamilies and tribes. Bradley died whilst working on a translation of Günther (1953), a likely explanation for some inaccuracies in the text. Bradley and Galil listed six families, seventeen subfamilies and thirty-three tribes, based around the suborders Areolatae and Anareolatae (the presence or absence of a sunken areola, a sharply defined region at the apex of the mid and hind tibiae).
- 1982 Kevan. *Phsmatoptera*. In: *Synopsis and Classification of Living Organisms*. A different classification, upgrading certain groups, effectively downgrading the old-fashioned groups Areolatae and Anareolatae. This rearrangement has not been widely accepted by researchers, although certain changes proposed have recently gained acceptance.
- 1983 Vickery. *Catalogue of Australian stick insects (Phsmida, Phsmatodea, Phsmatoptera, or Cheleutoptera)*. A useful listing intended as a first step towards revision of the order.
- 1996 Rentz. *Grasshopper country: the abundant orthopteroid insects of Australia*. An excellent, well illustrated general account of all orthopteroids, including the Phsmatodea, covering various subjects.
- 1998 Balderson, Rentz & Roach. Phsmatodea. In: *Zoological Catalogue of Australia* 23. An updated listing of all species.
- 2004 Zompro. *Review of the genera of the Areolatae, including the status of Timema and Agathemera (Insecta, Phsmatodea)*. A revision of the Areolatae only (most Australian species belong to the Anareolatae), including new families. Priority for phylogenetic relationships is given to egg morphology.
- 2005 Otte & Brock. *Phsmida Species File: Catalog of stick and leaf insects of the world*. This publication includes an updated 'Taxonomic Arrangement' and is the definitive

source of information about phasmid names. The Phasmida Species File <<http://phasimida.speciesfile.org>> (author: Paul D. Brock) is a taxonomic database of the world's Phasmida, which includes basic data from Otte & Brock and is continuously updated.

- 2007 Brock & Hasenpusch. New descriptions, many taxonomic changes and an updated checklist of Australian phasmids.
- 2008 Hennemann & Conle. Revision of Oriental Phasmatodea: The tribe Pharnaciini. Includes changes to higher classification, published as this book was going to press.

Bradler (2001) proposed that many phasmids of different appearance from the Australasian region are not representatives of different 'subfamilies', but members of one monophyletic endemic group he calls 'Lanceocercata' (features said to be: 1) cerci leaf-like flattened, often lancet-like and 2) males without vomer, replaced by a modified grasping structure). Detailed study of the Australian fauna (known to include some groups that migrated from Asia as the continent drifted into tropical latitudes) does not fully support Bradler's proposal (in any case, Henneman and Conle 2008 listed *Lanceocercata* as a synonym of the Family Phasmatidae), hence a familiar subfamily structure follows, otherwise using the latest classification (summarised in Otte & Brock, 2005), including the latest research by Hennemann and Conle, 2008. Key (1991) used a much simpler system, with two families (Phasmatidae and Phylliidae), also followed by Balderson et al (1998).

The chromosomal complements of 24 Australian phasmid species (some unidentified) range in number from 26 to 69, the larger numbers occurring in parthenogenetic species. Further studies are needed, particularly to assist with classification of closely related species, and in order to make use of improved technology. There are still mysteries to solve and a mixture of conventional taxonomic studies, rearing and studies on genetics will assist in improving our knowledge of these insects. A DNA barcoding initiative was started for phasmids in 2007, with the aim of assisting in classification of difficult cases.

Appendix 3: Checklist of Australian phasmids

This checklist of species is based on that published in Brock & Hasenpusch, 2007. Detailed information is available in recent catalogues (Balderson et al 1998; Otte & Brock, 2005 and the Phasmida Species File On-line) hence is not again reproduced here.

italics = synonyms

Suborder Verophasmatodea

Infraorder Anareolatae

Family Diapheromeridae

Subfamily Necrosiinae

Austrosipyloidea Brock & Hasenpusch, 2007

- A. carterus (Westwood, 1859) *Black-striped Stick-insect*
 - = *S. debilitata* Redtenbacher, 1908
 - = *S. filiformis* Redtenbacher, 1908

Candovia Stål, 1875

- C. aberrata (Brunner, 1907) *Aberrant Stick-insect*
- C. annulata (Brunner, 1907) *Banded-legged Stick-insect*
- C. coenosa (Gray, 1833) *Muddy Stick-insect*
 - = *Phasma* (*Bacteria*) *fragilis* Gray, 1833
- C. evoneoberti (Zompro & Adis, 2001) *Evoneoberti's Stick-insect*
- C. granulosa (Brunner, 1907) *Granulated Stick-insect*
- C. pallida (Sjöstedt, 1918) *Pale Stick-insect*
- C. peridromes (Westwood, 1859) *Sydney Stick-insect*
 - = *Clitarchus longipes* Brunner, 1907
 - = *Bacunculus tener* Brunner, 1907
 - = *Echetlus cercatus* (Redtenbacher, 1908)
- C. robinsoni Brock & Hasenpusch, 2007 *Robinson's Stick-insect*
- C. spurcata (Brunner, 1907) *Blue Mountain Stick-insect*
- C. strumosa (Redtenbacher, 1908) *Richmond River Stick-insect*

Cornicandovia Hasenpusch & Brock, 2007

- C. australica (Redtenbacher, 1908) *Lord Howe Horn-headed Stick-insect*

Leprocaulinus Uvarov, 1940 (now in Lonchodinae; research needed.)

- = *Leprocaulus* Redtenbacher, 1908

- L. insularis (Kirby, 1896) *Thursday Island Stick-insect*

Malandella Sjöstedt, 1918

- M. queenslandica Sjöstedt, 1918 *Queensland Malandella Stick-insect*

Mesaner Redtenbacher, 1908

- M. sarpedon (Westwood, 1859) *Dark-winged Stick-insect*
 - = *M. lineatus* Redtenbacher, 1908

Rhamphosipyloidea Redtenbacher, 1908

R. palumensis Hasenpusch & Brock, 2007 *Paluma Winged Beak-abdomen Stick-insect*

R. queenslandica (Sjöstedt, 1918) *Queensland Winged Beak-abdomen Stick-insect*

Scionecra Karny, 1923

S. milledgei Hasenpusch & Brock, 2007 *Milledge's Stick-insect*

S. queenslandica (Sjöstedt, 1918) *Queensland Scionecra Stick-insect*

Sipyloidea Brunner, 1893

S. bella (Tepper, 1905) *Beautiful-winged Stick-insect*
= *S. ovabdata* Rentz & John, 1987

S. brevicerci Hasenpusch & Brock, 2007 *Short-cerci Winged Stick-insect*

S. caeca (Sjöstedt, 1918) *Confused Winged Stick-insect*

S. garradungensis Hasenpusch & Brock, 2007 *Garradunga Green-winged Stick-insect*

S. gracilipes (Sjöstedt, 1918) *Graceful-winged Stick-insect*

S. larryi Hasenpusch & Brock, 2007 *Hurricane Larry Stick-insect*

S. lewisensis Hasenpusch & Brock, 2007 *Mt Lewis Winged Stick-insect*

S. nelida Rentz & John, 1987 *Nelida's Stick-insect*

S. rentzi Brock & Hasenpusch, 2007 *Rentz's Sipyloidea Stick-insect*

S. similis Rentz & John, 1987 *Similar Winged Stick-insect*

S. whitei Brock & Hasenpusch, 2007 *White's Stick-insect*

Spinosispyloidea Hasenpusch & Brock, 2007

S. doddi Hasenpusch & Brock, 2007 *Dodd's Spiny Stick-insect*

Subfamily Pachymorphinae***Acanthoderus*** Gray, 1835

A. spinosus (Gray, 1834) *Spiny Acanthoderus Stick-insect*

Pachymorpha Gray, 1835

P. simplicipes Serville, 1838 *Simple Pachymorpha Stick-insect*
= *P. pasithoe* (Westwood, 1859)

P. spinosa Brock & Hasenpusch, 2007 *Spiny Pachymorpha Stick-insect*

P. squalida (Gray, 1833) *Rough Pachymorpha Stick-insect*

Family Phasmatidae**Subfamily Eurycanthinae*****Dryococelus*** Gurney, 1947

D. australis (Montrouzier, 1855) *Lord Howe Island Stick-insect*
= *Eubulides spuria* Kirby, 1904

Eurycantha Boisduval, 1835= *Karabidion* Montrouzier, 1855*E. calcarata* Lucas, 1870 *Giant-spiny Stick-insect*= *E. sifia* Kirby, 1904***Neopromachus*** Giglio-Tos, 1912*N. sordidus* Kirby, 1896 *Dull-spiny Stick-insect***Subfamily Lonchodinae*****Austrocarausius*** Brock, 2000*A. mercurius* (Stål, 1877) *Plain Stick-insect*= *Carausius australicus* Brunner, 1907*A. nigropunctatus* (Kirby, 1896) *Black-spotted Stick-insect*= *Carausius macerrimus* Brunner, 1907***Denhama*** Werner, 1912*D. aussa* Werner, 1912 *Denham Stick-insect**D. austrocarinata* (Otte & Brock, 2005) *Australian Ridged Stick-insect*= *Marcenia carinata* Sjöstedt, 1918= *Hyrtacus cylindricus* Sjöstedt, 1918*D. eutrachelia* (Westwood, 1859) *WA Thin Stick-insect**D. gracilis* (Sjöstedt, 1918) *Graceful Stick-insect**D. longiceps* (Brunner, 1907) *Long Denhama Stick-insect*= *H. imitans* Brunner, 1907 (this may be a valid species, research in progress)*D. striata* (Sjöstedt, 1918) *Lined Stick-insect****Hyrtacus*** Stål, 1875= *Marcenia* Sjöstedt, 1918*H. caurus* (Tepper, 1905) *Tepper's Plain Stick-insect*= *Bacillus peristhenellus* Tepper, 1905= *Hyrtacus cunctatrix* (Sjöstedt, 1918)= *Hyrtacus nigrogranulosus* Sjöstedt, 1918*H. tuberculatus* Stål, 1875 *Lobed-abdomen Stick-insect*= *Marcenia frenchi* (Wood-Mason, 1877)**Subfamily Phasmatinae*****Acanthomima*** Kirby, 1904= *Ectus* Redtenbacher, 1908*A. rhipheus* (Westwood, 1859) *Spiny-thorax Stick-insect*= *Ectus solitarius* Redtenbacher, 1908***Acrophylla*** Gray, 1835= *Vetilia* Stål, 1875*A. caprella* (Westwood, 1859) *Lobe-legged Stick-insect**A. enceladus* (Gray, 1835) *Giant Acrophylla Stick-insect*= *Vetilia eurymedon* Stål, 1875

- A. *nubilosa* Tepper, 1905 *Cloudy Stick-insect*
 = *A. aliena* Redtenbacher, 1908
 = *A. paula* (Tepper, 1905)
- A. *thoon* (Stål, 1875) *Quick Stick-insect*
- A. *titan* (Macleay, 1826) *Titan Stick-insect*
- A. *wuelfingi* (Redtenbacher, 1908) *Wülfing's Stick-insect*
 = *Vetilia ligula* Redtenbacher, 1908
- Anchiale** Stål, 1875
 = *Ctenomorphodes* Karny, 1923
- A. *austrotessulata* Brock & Hasenpusch, 2007 *Tessellated Stick-insect*
 = *Ctenomorphodes tessulata* (Gray, 1835)
- A. *briareus* (Gray, 1834) *Strong Stick-insect*
 = *Ctenomorpha macleayi* Gray, 1835
 = *Ctenomorpha nigrovaria* Stål, 1875
 = *Ctenomorpha albopunctatum* (Kirby, 1896)
- A. *spenicollis* (Gray, 1833) *Spiny Anchiale Stick-insect*
 = *Diura japetus* Gray, 1833
- Anophelepis** Westwood, 1859
 = *Carnacia* Sjöstedt, 1918
- A. *telesphorus* Westwood, 1859 *Short-winged Stick-insect*
 = *Carnacia obscura* Sjöstedt, 1918
- Arphax** Stål, 1875
 = *Austroclonistria* Redtenbacher, 1908
- A. *australis* (Charpentier, 1845) *Australian Arphax Stick-insect*
- A. *brunneus* (Gray, 1833) *Brown Arphax Stick-insect*
- A. *dolomedes* (Westwood, 1859) *Crafty Arphax Stick-insect*
 = *Austroclonistria serrulata* Redtenbacher, 1908
- A. *michaelseni* Werner, 1912 *Michaelsen's Arphax Stick-insect*
- A. *signatus* Brunner, 1907 *Striped Arphax Stick-insect*
- Cigarrophasma** Brock & Hasenpusch, 2001
 C. *tessellatum* Brock & Hasenpusch, 2001 *Cigar Stick-insect*
- Ctenomorpha** Gray, 1833
 C. *gargantua* Hasenpusch & Brock, 2006 *Gargantuan Stick-insect*
- C. *marginipennis* Gray, 1833 *Margined-winged Stick-insect*
 = *Diura chronus* Gray, 1833
 = *Paractenomorpha macrotegmus* (Tepper, 1887)
 = *Acrophylla tasmaniensis* Lea, 1902
 = *Acrophylla oxyacantha* Redtenbacher, 1908
 = *Acrophylla phyllocerca* Redtenbacher, 1908
 = *Acrophylla scutigera* Redtenbacher, 1908

***Echetlus* Stål, 1875**

E. peristhenes (Westwood, 1859) *WA slender Stick-insect*

***Eurycnema* Serville, 1838**

E. goliath (Gray, 1834) *Goliath Stick-insect*

= *Ctenomorpha acheron* Gray, 1834

= *Clemacantha regale* Rainbow, 1897

= *E. magnifica* Kirby, 1904

= *E. viridissima* Kirby, 1904

E. osiris (Gray, 1834) *Darwin Stick-insect*

= *Acrophylla salmactis* Westwood, 1859

= *E. cercata* Redtenbacher, 1902

= *E. stenocerca* Redtenbacher, 1908

***Hermarchus* Stål, 1875**

H. insignis (Kaup & Heyden, 1871) *Distinguished Stick-insect*

= *H. polynesicus* Redtenbacher, 1908

***Onchestus* Stål, 1877**

O. gorgus (Westwood, 1859) *Gorgon Stick-insect*

O. rentzi Brock & Hasenpusch, 2006 *Rentz's Stick-insect*

***Paractenomorpha* Hennemann & Conle, 2004**

P. baehri Hennemann & Conle, 2004 *Baehr's Stick-insect*

***Paronchestus* Redtenbacher, 1908**

P. charon Redtenbacher, 1908 *Spiky-thorax Stick-insect*

P. cornutus (Tepper, 1905) *Horned Stick-insect*

P. pasimachus (Westwood, 1859) *Slender-dark Stick-insect*

***Ramulus* Saussure, 1862 (Now in subfamily Clitumninae, which has c. 300 mainly Asian species.)**

= *Clitumnus* Stål, 1875

= *Dagys* Günther, 1935

= *Dubreulia* Brunner, 1907

= *Paraclitumnus* Brunner, 1893

R. stilpnoides (Kirby, 1896) *Christmas Island Stick-insect*

***Vasilissa* Kirby, 1896**

V. walkeri Kirby, 1896 *Walker's Stick-insect*

Subfamily Platycraninae***Davidrentzia* Brock & Hasenpusch, 2007**

D. valida Brock & Hasenpusch, 2007 *Rentz's Strong Stick-insect*

***Megacrania* Kaup, 1871**

M. batesii (Kirby, 1896) *Peppermint Stick-insect*

Note: It is possible that a different *Megacrania* species is found in the Sir Edward Pellew Islands (research by Hsiung in progress).

Subfamily Tropidoderinae

Didymuria Kirby, 1904 (Now regarded as an uncertain genus in the Tropidoderinae.)

D. violescens (Leach, 1814) *Spur-legged Stick-insect*

= *Diura roseipennis* Gray, 1833

= *Diura discolor* Redtenbacher, 1908

D. virginea Stål, 1875 *Cape York Stick-insect*

Extatosoma Gray, 1833 (Now in subfamily Extatosomatinae.)

E. tiaratum tiaratum (Macleay, 1826) *Macleay's Spectre*

= *E. hopei* Gray, 1833

E. tiaratum bufonium Westwood, 1874

= *E. elongatum* Froggatt, 1922

Lysicles Stål, 1877

L. hippolytus Stål, 1877 *Lysicles Stick-insect*

L. periphanes (Westwood, 1859) *Swan River Stick-insect*

Malandania Sjöstedt, 1918

M. pulchra Sjöstedt, 1918 *Beautiful Malanda Stick-insect*

Micropodacanthus Brock & Hasenpusch, 2007

M. mouldsi Brock & Hasenpusch, 2007 *Moulds's Stick-insect*

M. sztrakai Brock & Hasenpusch, 2007 *Jiva's Stick-insect*

Parapodacanthus Brock, 2003

P. hasenpuschorum Brock, 2003 *Hasenpusch Family Stick-insect*

Paratropidoderus Brock & Hasenpusch new genus

P. spinosus Brock & Hasenpusch, 2007 *Orange-spined Stick-insect*

Podacanthus Gray, 1833

P. keyi Brock & Hasenpusch, 2007 *Key's Stick-insect*

P. typhon Gray, 1833 *Large Pink-winged Stick-insect*

= *P. unicolor* Charpentier, 1845

P. viridiroseus Gray, 1835 *Red-winged Stick-insect*

P. wilkinsoni Macleay, 1881 *Ringbarker Stick-insect*

Tropidoderus Gray, 1835

= *Trigonoderus* Gray, 1833

= *Athertonia* Sjöstedt, 1918

= *Kimberleyana* Sjöstedt, 1918

T. childrenii (Gray, 1833) *Children's Stick-insect*

= *Diura typhaeus* Gray, 1833

= *Tropidoderus iodomus* McCoy, 1882

= *Tropidoderus decipiens* Rainbow, 1897

T. gracilifemur (Sjöstedt, 1918) *Sjöstedt's Graceful Stick-insect*

T. michaelsoni Werner, 1912 *Michaelson's Stick-insect*

T. prasina (Sjöstedt, 1918) *Green Stick-insect*

T. rhodomus McCoy, 1882 *Red-shouldered Stick-insect*

Subfamily Xeroderinae*Xeroderus* Gray, 1835= *Cooktownia* Sjöstedt, 1918*X. kirbii* Gray, 1835 *Kirby's Stick-insect*= *Cooktownia plana* Sjöstedt, 1918**Infraorder Areolatae****Family Phylliidae****Subfamily Phylliinae***Chitoniscus* Stål, 1875*C. lobiventris* (Blanchard, 1853) *Lobed Leaf-insect**Nanophyllium* Redtenbacher, 1906*N. pygmaeum* Redtenbacher, 1906 *Pygmy Leaf-insect**Phyllium* (Phyllium) Illiger, 1798*P. monteithi* Brock & Hasenpusch, 2003 *Monteith's Leaf-insect***Erroneous Australian records:**

- *Anchiale maculata* (Olivier, 1792) (= *Mantis cylindrica* Gmelin, 1788, *Phasma naevium* Lichtenstein, 1802, *Phasma nocydaloides* Stoll, 1813, *A. confusa* Sharp, 1898 and *A. stollii* Sharp, 1898). This common New Guinea species has been misidentified, probably for the larger form of *Anchiale briareus* from northern Queensland, which is similar in general appearance.
- *Bacunculus ignotus* Redtenbacher, 1908 from an unknown locality, but listed as Australian by Vickery, 1983, who transferred it to *Parasipyloidea*. At best this rather plain insect may be a *Candovia* species, but we are not convinced as the genitalia do not entirely match.
- *Ctenomorpha haworthii* Gray, 1835 from 'Australia' was reported by Westwood, 1859 from 'Africa australi (nec Australia)' (a synonym of *Bactrododema hecticum* (Lichtenstein, 1796)).
- *Heteropteryx australis* Kirby, 1896 from 'Australia' is a synonym of *Haaniella grayii* Westwood, 1859 and the locality believed to be in error, as this species is common in Borneo.
- *Ophicrania striatocollis* Kaup, 1871 from 'New Holland', but the data labels also indicate Moluccas.
- *Phyllium frondosum* Redtenbacher, 1908 and *Phyllium siccifolium* L. 1758 listed in Vickery, 1983, but misidentified (Brock & Hasenpusch, 2003).

Glossary

- abdomen**
the third, rear part of an insect
- abdominal segments**
subdivisions of the insect abdomen
– in phasmids range from 1st segment (median segment) to 10th segment (anal segment) or, where present, a supra-anal plate (11th segment)
- adult**
the final (mature) stage of an insect, during which reproduction occurs (often by way of parthenogenesis in phasmids)
- anal segment**
the 10th abdominal segment, i.e. the last full-sized segment
- antenna (plural: antennae)**
the paired sensory appendages of the head, also known as ‘feelers’
- apical**
at or near the apex (end) of any structure
- autotomy**
shedding or breaking off of a damaged limb at a specialised point between trochanter and femur, with subsequent regeneration – applies to nymphs in phasmids, adults cannot regenerate lost limb(s)
- body length**
length from top of head to end of abdomen, excluding cerci and female operculum
- capitulum**
structure attached to the operculum in some phasmid eggs
- capsule**
external egg shell, excluding operculum
- carina**
a keel or ridge
- cercus (plural cerci)**
the paired, segmented appendages at the end of the abdomen
- clasper(s)**
in male insects, clasping organs hold the female during copulation (present in some phasmids; cerci are also sometimes used as claspers)
- compound eye**
a large eye made up of many separate units
- coxa**
basal segment of the insect leg
- culture**
to rear in artificial conditions in captivity
- diapause**
temporary seizure of development
- dimorphism**
differences in appearance of individuals of the same species, particularly between males and females
- dorsal**
upper surface
- egg**
first stage of an insect (hatches into a nymph in phasmids)
- endemic**
restricted to a given geographical region
- entomology**
the branch of zoology concerned with the study of insects
- family**
a rank within the family group between superfamily and subfamily
- female**
the sex in which eggs are developed
- femur (plural femora)**
the third segment and longest part of the insect leg, attached to the base of the body by the trochanter and coxa
- median segment**
the first abdominal segment, which is fused to a varying extent with the metanotum

- forewings
paired outgrowths of the second thoracic segment, also known as elytra and tegmina
- genus
an assemblage of species agreeing in one or more character(s) (the first scientific name of two for each species, e.g. *Acrophylla* in *Acrophylla titan*)
- granulose
covered with or made up of very small grains or granules (often on body of phasmids)
- gynandromorph
an insect combining the secondary male of female characters in the same individual
- head
first division of the insect body, bearing the mouth and antennae
- holotype (= type)
the single specimen designated as 'the type' by the original author at the time of publication of the original description, or the only specimen known at the time of the original description
- hindwings
paired outgrowths of the third thoracic segment, also known as alae
- karyotype
chromosome set
- kentromorphic phase
population-density induced morphological and pigmentation differences in pest species of phasmids (a term introduced by Ken Key for certain Australian phasmids)
- key
a tabulation of characters of species, genera etc., serving to identify taxa
- lateral
at or from the side
- lobe
a rounded projection of protuberance (in phasmids often linked with leg foliation)
- mesonotum
dorsal (upper) surface of the second thoracic segment
- mesothorax
the second thoracic segment
- metanotum
dorsal (upper) surface of the third thoracic segment
- metathorax
the third thoracic segment
- micropylar plate
often longitudinal, scar-like area associated with micropyle of eggs
- morphology
study of form or structure
- nocturnal
active at night
- nymph
the immature stage of insects, e.g. between egg and adult
- ocellus (plural ocelli)
simple beadlike eye (in some phasmids only, usually three ocelli between compound eyes)
- operculum
i) of female phasmids, the subgenital plate at the end of the abdomen;
ii) the lid of a phasmid egg
- ovipositor
the egg-laying apparatus of a female
- parasite
an organism that lives in or on another (the host), from which it obtains food, shelter, or other requirements
- parthenogenesis
egg development without fertilisation (usually into females only)
- phasmid
popular name in usage for stick and leaf insects
- Phasmida
from the Greek, *phasma*, = apparition, ghost; first proposed by Leach, 1815, for the insect order known as stick and leaf insects (= Phasmatoidea, Cheleutoptera, Phasmatoptera), mimics of twigs, stems and leaves
- phylogeny
the evolutionary history of a group of organisms

- pre-anal part of hindwing
the hardened part of the hindwing positioned above the soft wings, and supported by at least four parallel, equally spaced, veins
- pronotum
dorsal (upper) surface of the first thoracic segment
- prothorax
the first segment of the thorax
- species
form; kind; individuals alike in appearance and structure, mating freely (if bisexual) and bear fertile offspring resembling each other and their parents, including all varieties and races
- serration
a series of sawlike teeth
- spermatophore
a 'sperm package' produced by a male in order to fertilise the female
- subgenital plate
last hardened plate on underside of abdomen; operculum is normally used for females, subgenital plate or poculum for males
- spiracle
external opening of the tracheal system
- sub-
Latin prefix; under; slightly less than; not quite
- subfamily (plural: subfamilies)
major subdivisions of a family, containing a related group of tribes or genera, whose name ends in '-inae'
- subspecies
a subdivision of a species based on small difference in structure, colour or size and separated geographically from other such subdivisions
- subtruncate
almost squared off at the end
- supra-anal plate
the last hardened cuticular plate (or sclerite) of the upperside of the abdomen (where it occurs in females, usually visible in centre, slightly extending beyond anal segment)
- synonym
each of two or more scientific names of the same rank to denote the same taxon
- tarsus (plural tarsi)
the segmented foot of insects
- taxon (plural taxa)
a division or rank, in classification
- taxonomy
classification or its principles
- tibia (plural tibiae)
the fourth segment and second long portion of the leg
- tribe
subdivisions of a subfamily, containing a group of genera, the name of which ends in '-ini'
- trochanter
the second segment of the leg, articulating with the coxa and usually fixed to the femur
- truncate
squared off at the end
- tubercle
a small knob (in phasmids often on the thorax, sometimes on the head and abdomen)
- type specimen(s)
specimen(s) described in original description. Species described nowadays have one specimen (holotype) being regarded as 'the type'; others (paratypes) are secondary, but years ago an author may have deposited several syntypes in a museum collection, no single specimen designated as holotype
- ventral
underside
- vestigial
small, poorly developed, non-functional (e.g. wings)
- vomer
in male phasmids, movable sclerotization (hardened plate) from the underside of 10th abdominal segment, used during copulation

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More about phasmids

The following international organisations cater to the interests of people who study phasmids:

The Orthopterists' Society is open to all persons, professional and amateur, with an interest in orthopteroid insects. Membership includes a Newsletter *Metaleptea* with an option to subscribe to the highly regarded *Journal of Orthoptera Research*, which started in 1993 and contains original research on orthopteroid insects, including phasmids. Further information is available from: Executive Director, The Orthopterists' Society, USDA-ARS, 1500 North Central Avenue, Sidney, MT, 59270, USA, or from the website <<http://www.orthoptera.org>>.

The **Phasmid Study Group** is open to all persons with an interest in phasmids. Many members attend regular meetings and participate in the livestock exchange. Membership includes an informative and colourful quarterly newsletter and website access to *Phasmid Studies*, which is published usually at least annually, when there is sufficient material available. Further information is available from Paul D Brock, 2 Greenways Road, Brockenhurst, SO42 7RN, UK, or from the website <<http://phasmid-study-group.org/>>.

The **Phasmida Species File on-line** (author: Paul D Brock) is a taxonomic database of the world's Phasmida – the definitive source of information about phasmid names, which includes basic data from Otte & Brock (2005) and is continuously updated. It also includes images for many species, along with numerous literature references. <<http://phasmida.speciesfile.org>>

You can also see live phasmids at many butterfly houses and zoos. One of the best displays is the Bugs Alive Exhibition, Museum Victoria, Melbourne.

Information on stick insects, can be obtained from the Australian Insect Farm; these also feature on a 'Insects Make Great Pets' CD being published in early 2009. Website: <www.insectfarm.com.au>

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